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Detail Design.

A number of recent mishaps to structures and machines of widely varying character can be attributed to one cause only, the poor design of some small detail. A power canal had its banks badly washed out and the power station somewhat damaged because the lifting mechanism of the waste gates was not strong enough in one very small detail. A large engine of excellent construction has caused the builders much trouble and annoyance on account of some trifling details of the governor, which were not suitable for a large engine, although entirely appropriate for one of smaller size. A large, well-constructed building is proving unsatisfactory because the floor system is not quite strong enough for the use of light machinery, although the columns and girders are of ample size. Other recent examples of the same trouble might be cited.

In the great development of engineering responsibilities of late, the heads of engineering offices have been put under a severe strain. Their department is usually the first to feel the effect of a general order to reduce expenses, and the last to obtain an increased appropriation. The chief engineer necessarily has his attention on such broad problems that the details must be left to others. It so happens, moreover, that the average technical school of to-day, in its strife to secure students, lays great stress on its instruction in advanced work, the design of large power plants, long-span bridges, imposing dams, works so important that in actual practice consulting specialists are usually retained to assist in their design. The young man in a technical school is not forced to see that the little information he can obtain in the classroom concerning such great problems is only just about enough to enable him to talk about them intelligently. He absorbs the idea that the design of cotters and keys, of small riveting jobs, of springs and fly-ball governors is about on a par with the multiplication table—an educational item beneath his attention. When he graduates and begins work, he sees his chief thrust all details upon others and consequently fails to appreciate their importance.

It is not surprising that so many accidents occur through defective designs of details. It would be strange if they did not. So long as technical schools will give diplomas stating that the recipients are mechanical or civil or electrical or mining engineers to young fellows whose knowledge of arithmetic does not enable them to compete with a grocer's boy as computers, the trouble will continue. The men in responsible charge of engineering work are glad to get technical graduates for their offices, not because they know very much that is of practical value, but because they have learned the elements of so many subjects that they are able to take up any given duty of a minor character without difficulty. On the other hand, a young graduate should not be trusted any further than any other employe until his carefulness in all detail work is proved beyond question. He has had little incentive toward accuracy in his school work and he cannot be expected to acquire suddenly the habit of careful regard for small things. All of the recent troubles mentioned above were due to unwarranted reliance on young technical school graduates.

The Utilization of Inventions.

It seems not at all unlikely that one of the reasons that engineering brings such small returns to those following it is that they do not see accurately the results that their work renders possible. The average inventor is traditionally impractical. He is not only overenthusiastic concerning the operation of his inventions, but is given to wholly visionary opinions of their field of usefulness. The utility of the meritorious improvements made by sane and sober engineers do not often seem to be appreciated by others, however. Once in a while somebody like George Westinghouse will have the business ability as well as the engineering talent to push his inventions to commercial success, but as a rule the exploiting will be done by men who neither know nor care anything about engineering itself. What they insist on knowing is just what a new invention will cost, what it will accomplish and the manufacturing cost of the product made by it. In other words, the man who makes the most money out of an invention is the one who sells or uses it.

For example, take the small refrigerating machine. This is being employed in hotels, apartment houses and the like, and situations for which these machines are sold on a moderate profit. Of course, no inventor will think of putting up an apartment house in order to sell a refrigerating apparatus. On the other hand, the men who are making the most money out of these machines are the owners of small cold-storage plants, which are springing up rapidly in many parts of the country. In some parts of the wheat districts, the farmers have organized cooperative elevator companies, and other farmers are now organizing cold-storage companies in the same way. Dairy products, eggs and fruit are being kept where produced until the market conditions are favorable for their sale. This business does not cut into the large storage enterprises in the cities, and in fact it is of assistance to the large wholesalers.

This small storage business affords a good example of the fact that the most money to be made from an invention is to be found in its utilization. When an invention of real merit has been made, it must be introduced and it is the failure to grasp the necessity of educational work in introducing novelties that delays the adoption of desirable improvements. The construction of small cold-storage plants operated by gasoline engines was left for the farmers to undertake, and the slowness with which they have been undertaken has been due to the lack of encouragement given to them by the builders of such machinery. In contrast with this condition is that of the pneumatic tool business. This has reached its present astonishing development very largely through the educational work done by Mr. Duntley. He exhibited the tools in actual work in all the large cities where there were industries to use them. He sent out men to show how to keep them in condition and he sought far and wide for suggestions for their improvement.

The International Railway Congress.

The success of the International Railway Congress at Washington has been most gratifying, but it has been along lines that were hardly anticipated by those who had planned to turn to their personal advantage the peculiarities of the organization. These people forgot that men would not gather from all quarters of the world to listen to papers—or to discuss them—on subjects which have been threshed over so often as to be of trifling interest and even less novelty. In saying, therefore, that the papers and discussions amounted to little, no reflection is cast on the excellent way in which Messrs. Kendrick, Buchholz, Dudley and others summarized the knowledge in various special lines. They were requested to prepare these papers and their work was well done. The most useful part of the Congress has been unofficial, however, and not on the program. It was the informal interchange of information outside the halls where the sessions were held, the inspection, not yet completed, of the leading American railways, and the examination of the devices in use on them.

The exhibition of railway appliances at Washington was probably the most useful display of the kind yet undertaken. The use of the site was granted by Congress and two Cabinet officers took part in the opening ceremonies. About a million dollars was spent in less than two months to bring the exhibit into being, but the result justified this expenditure. The American railway cannot be understood unless the character and capabilities of American equipment are first grasped. Pullman and Westinghouse have done as much as Commodore Vanderbilt and Hill to raise railway transportation to its present high plane. Moreover, the small things have been as important as the large, as Secretary Taft pointed out at the opening ceremonies. "While we properly revere the names of the great inventors," he said, "we are apt to forget that those steps when taken were of the crudest and that but for the small inventions and the exhibition of American skill in applying the principles of these inventions to the progress of the world, the inventions themselves would not show such enormous steps in behalf of civilization." The great merit of the exhibition at Washington was its thoroughly representative character. The great corporations were fittingly represented by comprehensive displays of all their railway apparatus, while the smaller companies had plenty of space in which to show their specialties. The exhibition was really the best feature of the Congress, for without it the delegates would have been unable to appreciate some of the most interesting and characteristically American methods of the railways they are now inspecting.

The unofficial tours of inspection of railway properties which the delegates are now making, ought to show our visitors that many of the criticisms of American properties do not take into account all the conditions of their construction and operation. There have been no Board of Trade regulations here to prevent the construction of lines unless enough capital was provided at the outset to pay for expensive safety apparatus and the complete avoidance of grade crossings. There were many men in attendance at the convention who were personally engaged not so long ago on railway location in places where civilization had not gone. Our visitors are now seeing for themselves the marvelous growth of cities along the railway lines and are learning the very important fact that our railways have not ruthlessly crowded into the cities at the grades of the streets, but that the cities have swarmed up about the railways. They are being shown by our managers, by specific examples, that it is bad policy to put in permanent construction before the permanent location of the lines and stations is determined. They are seeing personally that a great many communities are receiving a valuable service from poorly built and equipped lines, which would be put out of business and these growing communities strangled, if we required the same expensive construction and equipment that are obligatory in some European countries. In short, they are learning to estimate our railways as pioneers of civilization, which is their grand achievement in American eyes.

Concrete Steel for Factory Walls and Floors.

It is probably safe to state even with emphasis that concrete-steel as a structural material has already found a permanent place in engineering construction, and that whatever may be the experiences realized in certain cases of failure, its future use will be greatly, and probably rapidly, extended. The Engineering Record has been a consistent and persistent advocate of the merits of this material in competently designed and well-built structures. From no other single source has there proceeded more rational or complete information of all kinds calculated to stimulate a correct and intelligent use of the concrete-steel combination, but at the same time it is equally true that from no other source has there been given more serious warning of the dangers resulting from the ignorant or unscrupulous use of this excellent material. Concrete-steel is so easily made and so readily adapted to a great variety of structural purposes that some, and possibly many constructors, either ignorantly or unscrupulously violate the first principles of both good design and careful production of a material requiring the most conscientious treatment at every stage, from the beginning to the end of the work.

If almost any grade of concrete be used in heavy masses, either with or without steel reinforcement, the result will be sufficiently satisfactory, unless its treatment be viciously bad. In other words the general character of concrete, as heretofore realized, like that of almost all masonry, is such as to lend itself successfully to massive construction. On the other hand it is the essence of good design in reinforced concrete to adapt it to successful use in the performance of severe duties in comparatively thin or light masses. This distinction lies at the very foundation of all safe and proper concrete-steel construction, especially where the structure is required to carry a load producing vibrations, as in factories or other buildings containing rapidly moving machinery.

It is one of the characteristic features of the setting of cement mortars and concrete in air to show sometimes great numbers of small or so-called "hair cracks," especially throughout the exposed surfaces, some of which frequently become cracks of considerable depth and width. One of the most beneficial results of the presence of the steel reinforcement in the combined material is the partial or complete prevention of these small or large cracks. At the same time it is frequently difficult in concrete-steel construction to avoid a change in the homogenity of the reinforcement along certain lines in the structure and cracks of magnitude are likely to occur along such lines. Such cracks do not necessarily in any way prejudice the stability or efficiency of the construction, but in order to avoid them it is imperative that the original design be most carefully made for the attainment of that purpose. It is obvious that these observations bear with the greatest intensity upon relatively thin masses of reinforced concrete, such as those employed in the walls and floors of buildings, or for other similar purposes.

There is again another physical element which exercises a marked influence upon the satisfactory employment of reinforced concrete where it is certain or even likely to be subject to vibrations, and that is the modulus of elasticity of the concrete. While the value of this modulus is not so well defined as that of steel, it may be taken at 2,500,000 pounds for ordinary structural conditions. When it is remembered that the corresponding modulus for steel is 30,000,000 pounds or twelve times as great as for concrete, it may be at once concluded that the vibrations of the walls and floors of a factory building carrying rapidly moving machinery may, under some circumstances at least, be from ten to twelve times as great as for a steel frame structure, or possibly more. It may not be quite accurate to take the resulting motions of vibration inversely as the moduli of elasticity, in consequence of the relative vibrating masses or intensities of stress being enough different from those assumed for that purpose to vitiate the proportion, but that assumption cannot be far wrong, and it may be essentially right.

The relatively low elasticity of the concrete not only gives opportunity for relatively large vibrations, but also tends to set up those vibrations with a much less motion of machinery or other moving load than would be the case with an all-steel frame. Such vibratory motions would not necessarily be productive of prejudicial results with complete continuity of all the materials involved, but when a tendency to even the smallest cracks exists either in floors or walls it may easily be imagined that failures may result where least expected. These are considerations which might frequently be rejected as hyper-refined and consequently of little practical weight. As a matter of fact, however, they are based upon physical conditions just as real and just as rational in every way as the simplest and most practical computations made in any completed design; in other words, they are wholly practical and belong to the simplest and most fundamental elements of structural work.

It is obvious that the prejudicial conditions attending the employment of badly designed or fabricated concrete-steel for buildings subject to vibration will be greatly aggravated if the buildings are put into use before the concrete has requisite age.

There have been, for such a matter, a large number of failures of buildings with walls and floors of reinforced concrete. There is no more mystery about such failures than about any other failures of engineering structures. In every such case the material is simply stressed beyond its resisting power. Sometimes this overstressing results from one cause and sometimes from another, but the general result is the same. In perhaps most, and possibly all, of the failures of reinforced concrete walls and floors of industrial buildings there is reason to believe that either the design or the material, or both, have been bad, and it may be that in some cases the concrete has had insufficient age before placing load upon it.

It should go without saying that no such failures can occur if the walls and floors are properly designed and if an excellent quality of concrete is employed. The preceding considerations show that it is imperative not only to use the best quality of concrete and put it in place in a proper manner, but also that the steel reinforcement should be distributed in accordance with established principles. It is further evident that where vibrations are likely to occur the steel reinforcement should be judiciously placed and substantially more of it should be used than in the ordinary concrete-steel beam. In short, concrete-steel in walls and floors of buildings carrying vibrating machinery, or in walls and floors generally, must be the object of careful and skilled engineering design and construction; ignorant and unscrupulous work will be certain to lead to failure.

The American Water-Works Association.

The convention of the American Water-Works Association this week was the most successful in its twenty-five years of existence. The recent growth of the organization has been steady and along lines calculated to increase its usefulness, as was shown by the character of the papers presented. It is a pleasure to record these facts because the water-works interests of the country are so great that a strong association representing them is necessary. It is too commonly considered that the only part of water-works affairs that amounts to anything is the engineering side, but this is wholly erroneous. The operative and administrative sides are as important as those of street railway and lighting interests, and the Association very wisely is devoting a large part of its attention to them. There is the greatest need of this because so many water plants are under municipal control in which conservatism of management has a tendency to be carried to excess. Moreover, some of the most serious problems now before the water-works manager are wholly administrative, such as the fire-protection supply to industrial establishments and the control of waste.

A large part of the work of the superintendent is also directed in many plants to preserving and improving the quality of the supply. This responsibility puts upon him the task of keeping in touch with the rapid progress in water purification. This is a specialty in itself, one which the water-works manager very wisely is leaving to specialists. But the cost and results of the various systems and their general management to produce the best results are directly in his province and the Association affords the best place for a discussion of these phases of water purification. The members of the Association are acquiring practical experience in the management of such plants and the exchange of the results of this experience with the laboratory research work of the specialists will shortly become a very important feature of the conventions.

The discussion of engineering subjects by the Association is a matter on which there has been considerable debate in the past. This journal believes that the best results will be secured if the strictly engineering subjects are not taken up. There are plenty of engineering societies for their consideration already in existence. On the other hand, the Association seems the fitting place for papers on the engineering aspect of water-works administration, papers of the type of the valuable discussion of commercial pumping engines read this week by Mr. Hague. It is noteworthy that papers of this character have aroused animated discussion, while those on more strictly engineering subjects have not always received the attention they merited. In making these comments, The Engineering Record is expressing not only its own opinion, but also that of many of those members who have been most instrumental in bringing about its recent development in influence and in numbers. This development will continue if the Association is kept primarily a water-works society, broad in its scope and liberal in its policies, but nevertheless an organization primarily for the superintendent and manager. Conventions like that at West Baden this week will help strengthen this position.

The Overstating of Electrical Comparisons.

In comparing two methods of executing a given purpose it is manifestly desirable to state each method fairly. The worst conditions of one method should not be compared with the best of another. This reflection is suggested by a statement recently made before the Canadian Railway Club by Mr. W. N. Dietrich, electrical engineer of the Canadian Pacific Ry., concerning an 8-in. shaft about 350 ft. long which he saw in an elevator. When it was removed to enable the journals to be lined up, it was found that some of them had dropped out of alignment as much as 2½ in., indicating that the shafting had acted as a brace for the entire building. It was asserted that fully half of the power supplied to this shaft was absorbed by the journals, and this does not seem at all unlikely. As an example of bad shafting, this particular line is of interest, but it is hardly just to follow the description of it with the following statement: "The efficiency of the electric drive, on the other hand, in a large and well-designed plant should not be less, between generators and machine tools, than 73 per cent. on full load and 65 per cent. on half load." It is not at all difficult to find electrical installations in which no such efficiency is attained, in fact, the worst mechanical installation of any nature with which this journal is acquainted is an electric power plant in Michigan.

As a matter of fact, Mr. Dietrich probably had no intention of making such an unfair comparison as his words suggest, for elsewhere in his paper he states the argument for the electric drive with admirable precision. The cost of power in machine shop work is about 5 per cent. of the total cost of production, and a saving of 20 per cent. in power will represent only a 1 per cent. reduction in the total charges. The advantage of the electric drive lies elsewhere, and is stated as follows by the author: "In repair shops the cost of labor is the largest item and increased output is the keynote in reducing this cost. Two factors govern the output of a tool, first, the capacity of the tool, and second, the ability of the operator to work the tool up to its capacity. A study of certain tools will show the desirability of placing in the hands of the operator means to enable him to start his work at a speed which at first appears to him to be about right, and to vary this speed in small and large increments to what he considers to be the maximum as determined by the appearance of the work as it progresses. In some cases the maximum output will be governed by the quality of the tool steel and in others by the strength of the machine itself. In order to get the greatest output the operator must be provided with variable speed through small increments and convenient control; the rest will depend on the man."

It is certain, however, that the introduction of the variable speed motor for tools doing a variety of work will call for increased attention on the part of the foreman. The machinists are able to determine quickly and accurately the correct speed for most economical working, but the foremen have themselves to learn these speeds and to see that they are employed. They have to know the best relation of speed and depth of cut, and this knowledge is not so common as it ought to be, particularly since high-speed tool steel has been introduced. As Mr. Pomeroy pointed out in the discussion, there are shops where no two men are using the same feed for the same work, and the foreman in charge of the department cannot tell which is right. This is, of course, all wrong, and the advantage of the electric drive will not amount to much until the tools are calibrated for each class of work for which they will be used. Mr. W. D. Robb stated that this was recognized some time ago by the company with which he is connected, and an expert machinist was placed in each shop to see that the best results are obtained. These experts visit the different shops and discuss among themselves the work in their charge. They report to the master mechanics concerning all important subjects, and the value of their services in increasing the output of the shops has been clearly shown.

Notes and Comments.

The Watershed Forestry Work which is being done by the Middletown Water Department, with the assistance of the State Forester of Connecticut, is progressing finely. At one reservoir, where 168 acres must be planted, about one-fourth of the trees are set out, and about three-fifths of the remaining seedlings are growing.

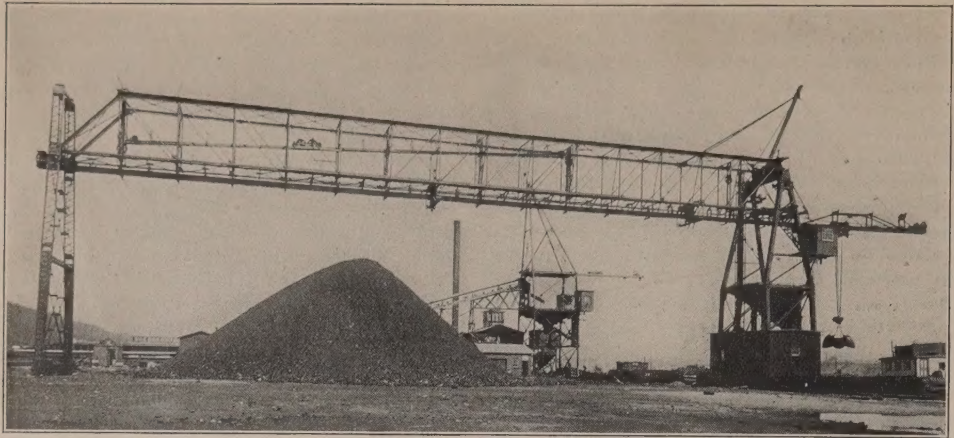
The Failure of a Dam near Nevada City caused considerable stir in the Western newspapers recently, but it amounted to nothing. Mr. A. D. Foote writes that the structure was of small size and of the crib type, built of second-growth pine and bolted to the bed rock. The timber was all sapwood and rotted out until the bolts had nothing to hold. When the dam went out the damage consisted solely of the washout of a bridge of little value and the spraining of the ankle of a small girl while running to see the flood sweep downstream.

A Water-Tank Gauge of novel construction, which will doubtless be useful in a good many stations where the engineer is required to keep an elevated tank full, is described in the "American Electrician" by Mr. John D. Adams. A float with an attached cord running down to a scale in some place visible from the engine room will answer for a low tower, but it is impracticable with a high one. As a substitute Mr. Adams has run a ¼-in. pipe from the tank into a mercury gauge in the engine room. This gauge is merely a large U-tube with the water column acting on one leg balanced by the mercury in the other leg. At the top of the mercury is a gauge glass indicating the height of the water in the tank.

The Failure of a Rink Roof in Cleveland again calls attention to the serious danger these wide-span timber structures often present. A few years ago the roof of a new rink at Sault Ste. Marie collapsed during the night time just after it was completed. Fortunately nobody was in the building at the time. In the case of the Cleveland structure, a number of skaters warned by the creaking of the timbers, had just time to hurry out before the roof fell. The season is now approaching for another similar class of failures, those of grandstands, to occur. These accidents are so numerous that the city officials intrusted with the safety of the people ought to exercise great care in permitting people to enter auditoriums about which there is the slightest question. The construction of these rattletraps cannot always be prevented under existing building regulations, but the police and health departments can probably find ways to prevent their use.

The Manila Electric Railway which was opened a few days ago is one of the leading improvements in the Philippines due to American control of the islands. There was formerly a very poor horse-car service in the city and a short steam tramway into the suburbs, but these were of very primitive character compared with 40 miles of city and suburban electric railway which is now being put into operation. This has 70-lb. rail, a 100x170-ft. power station with Babcock & Wilcox boilers, Westinghouse-Parsons turbo-generators and about a hundred cars. The enterprise has been carried through by J. G. White & Co., and was rendered particularly difficult by the remoteness of Manila from all sources of mechanical supplies. Accordingly unusually complete shops have been built, provision has been made for storing 10,000 tons of coal, which comes from Australia and costs about $5.75 delivered at the boiler, and such minor departments as a printing office for getting out tickets, forms, time tables and advertising posters.

A Second Single-Phase Railway has recently been opened for regular operation over a part of its line, and the service will be extended as rapidly as possible over the whole route from Joliet to Bloomington, a distance of 90 miles. This line is equipped with the General Electric system already explained in this journal. Current is furnished to the line at 3,300 volts and transformed to lower voltages on the car; no difficulty is experienced in collecting the current with a 5½-in. underrunning trolley wheel. The trolley wire is suspended from cables which are attached to special insulators on the poles. Both the cables and the trolley wires carry the 3,300-volt current, and it is probable that some valuable data concerning the best form of trolley suspension will be afforded by the experience gained on this road. The car adopted for this road weighs 29 tons and has two Brill trucks with 34-in. wheels having M. C. B. treads and flanges. Four 75-hp. motors are used and these can develop such speed that some very interesting tests will be possible in the future when a larger stretch is in operation than the 10.4 miles over which a car is now running. The extension of the service will also bring out some valuable information concerning the number of sub-stations necessary with a high-voltage trolley line. When this information is obtained, it will be practicable to determine with considerably higher accuracy than now the advisability of equipping any interurban railway electrically.



The Large Gantry Bridge Spaning the Bituminous Coal Pile.

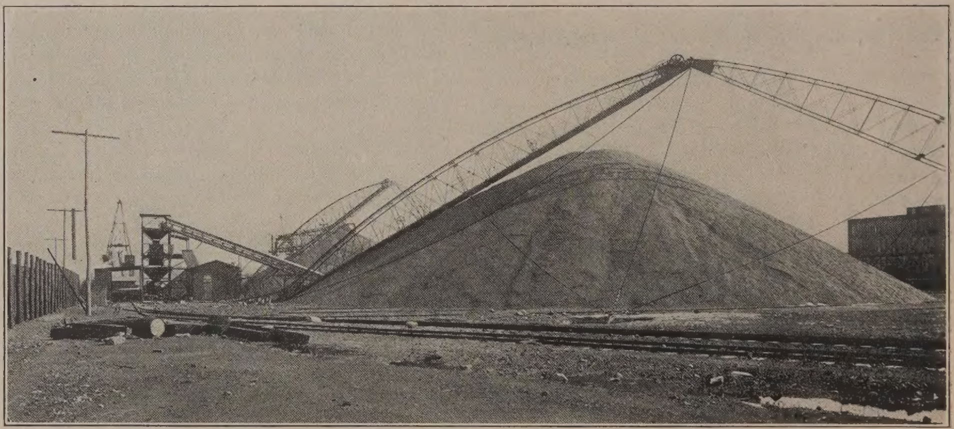
THE SHADYSIDE COAL STORAGE PLANT OF THE NEW YORK EDISON CO.

In recognition of the importance of maintaining a large reserve fuel supply for insuring continuity of operation of its power plants, the New York Edison Co. has recently installed an extensive storage plant which possesses many features of interest, not the least of which is the handling and storing of bituminous coal. The new facilities provide for a reserve supply of 100,000 tons of anthracite and 50,000 tons of bituminous, which may be drawn upon in case of emergency, such as would result from a tie-up of the railroads from any cause or combination of circumstances resulting in a coal famine. From the fact that the large new waterside station of the company in the city of New York consumes 1,000 tons of coal per day on the average and that the total coal-bunker supply at the station would not hold out for more than about 10 days if all further supply were cut off, the importance of the storage plant will be evident. Owing to lack of available space in close proximity to the waterside station of the company at 34th St. and East River in New York, the storage plant was located at Shadyside, N. J., a point on the Hudson River about opposite 110th St. in New York. Here convenient connections were made with the New York, Susquehanna & Western, the New York, Ontario & Western and other railroads from the coal districts, and the necessary dockage facilities are available for reshipment by boat to the stations in New York. A plot of ground with 460 ft. frontage on the river and a depth of 1,500 ft. was secured, and at the waterfront a dock 20 ft. in width was installed to carry the high-speed hoisting tower and bridge tramway for handling to and from boats. The ground at the rear of the dock is filled with cinders that serve as a floor beneath the piles of coal in open storage.

The yard is laid out for two anthracite piles of 50,000 tons each and, adjacent to the dock, a 50,000-ton bituminous pile; the rear of the site is occupied by storehouses for miscellaneous storage for the company, and, in addition, there is room for an additional anthracite pile if needed. The anthracite coal is handled by Dodge trimmers for piling and a Dodge radial pivotal reloader for removal, delivery being made by belt conveyor to the dock, where a steeple tower is installed for the loading and unloading of boats. The bituminous coal is stored in a rectangular pile, the handling to and from boat being accomplished by a traversing bridge tramway which spans the pile. The entire coal handling equipment was designed and installed by the Dodge Coal Storage Co., Philadelphia, Pa.

The construction of the traversing bridge for the bituminous coal pile is shown in the accompanying illustrations. The bridge carrying the trolley for cross movements of the coal bucket has a span of 200 ft. between centers of supports, the clear height under the trolley runway being sufficient to permit handling the bucket over a 30 ft. pile of coal. The bridge is supported at the dock end by a tower 67 ft. in height, which carries in the housing at its base the boiler and engines for operating the hoists, trolley traverse and longitudinal movements. The structure is carried on three lines of rails, extending over 400 ft. along the line of the dock so as to cover all parts of the pile; in moving the structure is operated by its own power.

The coal is handled by a 2-ton clam-shell bucket which travels on a runway connecting with a boom projecting over the water for unloading from boats. The boom is of sufficient length to permit the bucket to be extended out 40 ft. beyond the dock line, and it may be lifted to a vertical position to permit of masted vessels passing when docking. For loading vessels the bucket discharges into a 40-ton steel hopper above the engine housing, from which a swiveling outboard chute is hung for delivering and trimming. Two standard engines are used for the operation of the bucket, one for the closing and hoisting and the other for the trolley traverse; the former has 12 x 12-inch cylinders and the latter 10 x 12-inch cylinders. Steam is supplied to these engines by a 5 x 12-ft. vertical tubular boiler also carried in the tower.



General View of the Anthracite Coal Piles and Dodge Handling Apparatus.

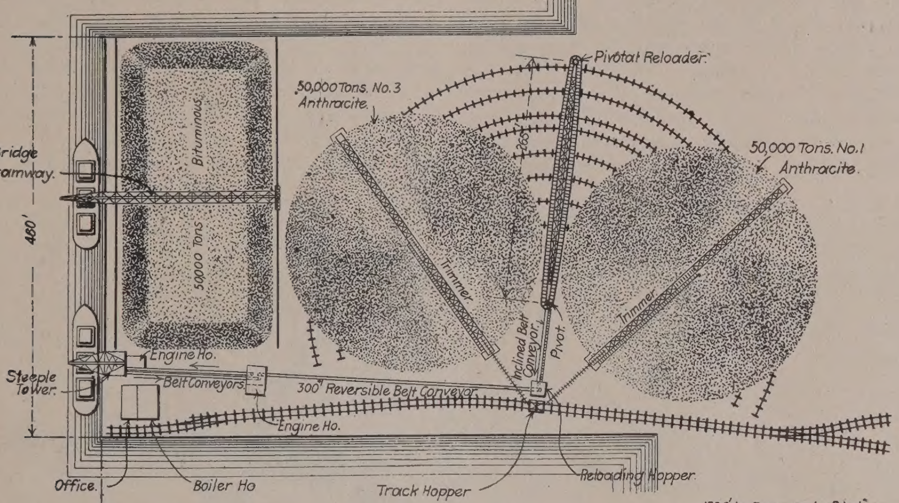
While the bituminous coal is arranged for handling only by boat, the anthracite handling plant is designed for receiving either by boat or rail. When by rail it is dumped from cars directly into a track hopper from which the Dodge trimmers distribute to the circular piles. The trimmers are of the standard Dodge type of inclined truss with scraper conveyor leading up one side; openings in the scraper trough permit the coal to be dumped at any point on the pile desired. When the coal is received by boat it is handled by a steeple tower at the dock, which, by means of a 1½-ton clam-shell bucket, lifts the coal onto a belt conveyor system; this extends back and delivers into the track hopper near the anthracite piles, which feeds the trimmers, as when received by rail.

The steeple tower, permanently located on a dock, has a total height of 99 ft., while the overhanging boom permits of an extreme position of the bucket of 30 ft. beyond the dock line. The trolley runway extends back over a 40-ton hopper in the upper part of the tower, below which are two weighing hoppers, and still below these a discharging hopper for delivering the coal received to the belt conveyor leading back to the trimmers. The 40-ton hopper into which the clamshell bucket dumps has sufficient capacity to keep the weighing process continuously in operation when unloading from boat. The weighing is accomplished by keeping the two weighing hoppers, which are of five tons capacity each, alternately filling and dumping; when one becomes filled the feed is shifted to the other, etc., so that the process is simplified to a mere counting of the number of times each hopper is filled.

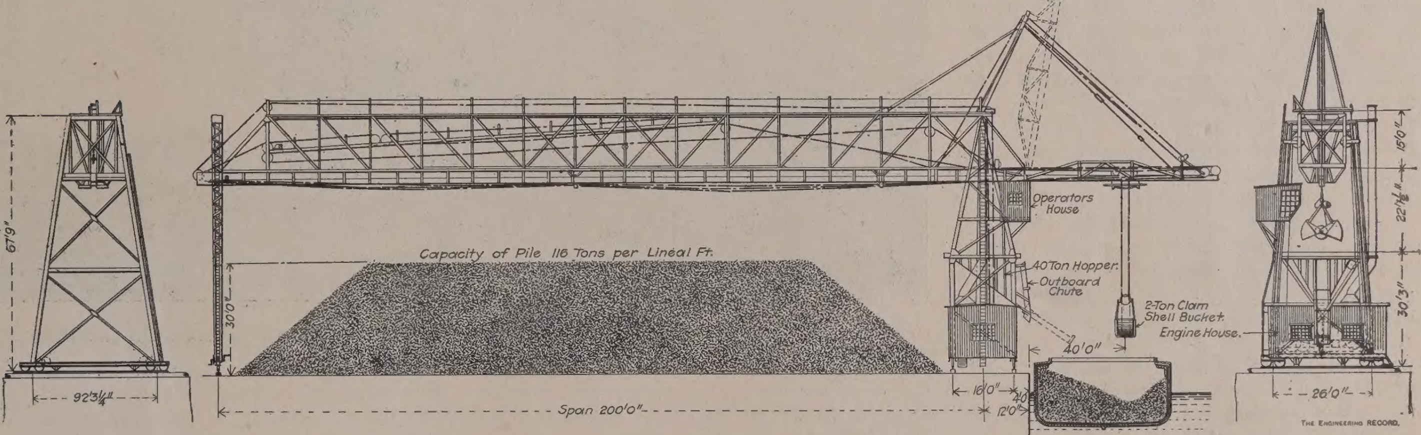
The bucket in this tower is operated by double cylinder engines consisting of a smaller engine superimposed above a larger one; the smaller, which has 10x12-in. cylinders, operates the trolley, while the larger, with 15 x 24-inch cylinders, operates the bucket-closing and hoist. These engines are both of the direct-connected type so that the hoisting and traversing movements are unusually rapid; the cable drums which are 30 and 32 ins. in diameter, respectively, are mounted directly upon the engine shafts, being connected at will by special friction clutches. These are controlled from the operating houses for all movements, the hoist by one man and the traverse by another, for facilitating the work. Very rapid unloading has been secured with this arrangement, as many as 4 trips of the bucket per minute being possible under favorable conditions, and 2½ trips per minute, or 150 per hour being an average working rate—a capacity thus of 225 tons per hour.

The arrangement of the belt conveyors is shown in the yard plan. A 24-inch reversible belt conveyor extends from the track hopper between the trimmers to the engine house, where it discharges onto a 24-inch inclined belt conveyor delivering up into the 40-ton hopper in the tower for loading into vessels, or receives by another inclined, descending, belt conveyor of the same size, coal, that is taken from vessels and weighed in steeple tower, and discharges it onto the storage piles. The belts are operated at a speed of 600 ft. per minute, being driven by a 12 x 16-inch single engine, located in the small engine house situated midway between steeple tower and storage piles. The combined capacity of the unloading and weighing apparatus in the steeple tower, and the belt conveyor system and trimmers, is about 800 tons per day of 10 hours when operating under average conditions, although under the most favorable conditions nearly 1,200 tons have been handled in 10 hours.

The reloading system for removing coal from the piles is a reversible side scraper conveyor of the pivotal type swinging over a radius of 300 ft., which delivers at its pivot to a 30-inch inclined belt feeding 5-ton weighing hoppers that spout to the reversible conveyor. It is carried on 10 lines of circular track, one of which is used for the cable mechanism for moving the reloader into the piles; the possible movement is sufficient to cover the entire area occupied by both piles. This reloader, as well as the trimmer mechanisms, is operated by a 16 x 18-inch single engine in house at rear of reloader tower between the piles. The capacity of the reloader is, under ordinary conditions, 1,500 tons per 10 hours, although this rate has been considerably exceeded.



Plan of the New Coal Storage Plant of the New York Edison Company at Shadyside, N. J.



Details of the Traversing Gantry Bridge for the Handling of the Bituminous Coal in the Rectangular Pile.

Steam is supplied to the three engine equipments for operating the anthracite handling system by a boiler plant in a building near the dock which also serves as an electric lighting plant, shop and office. There are two 6 x 18-ft. horizontal tubular boilers, rated at 150 h.p. each. The lighting plant comprises, a 100 k.w. General Electric 240-volt generator which is direct-connected to a 150 h.p. Ball & Wood simple engine; this is used for lighting the yard and apparatus, about 250 incandescent lamps being distributed for night operation. The pivotal reloader operating house is equipped with a searchlight to permit of closely watching the piles in reloading at night; this is necessitated by the tendency of the piles to cave in upon and bury the reloader, which when watched may be moved backward out of the way during a "slide."

The Commercial Pumping Engine.

Abstract of a paper presented to the American Water Works Association by Charles A. Hague.

The "commercial" pumping engine has almost completely taken the place of the "special" pumping engine by the sheer force of repetition, until what a few years ago was only available through special talent and occasional opportunity, is now equaled and sometimes excelled by the regular output of several establishments enjoying enough of a business to keep a staff at work upon the water works pumping engine as a sort of commercial product.

Under such conditions the matter of specifications would seem, at first glance to be very simple, and perhaps it is, to those builders who understand and have the courage to offer what they really know ought to be furnished; but competition coupled with the strongly grounded idea that a contract should go to the lowest bidder, will interfere with the rational treatment of the subject. Besides this, there is a tendency to stipulate that the builder of pumping engines must provide all sub-foundations, foundations proper, do excavating, cut into and replace masonry, floors, walls and whatever may be changed in the course of the installation of the machinery, thereby inflicting upon the maker of machinery a lot of work entirely outside his legitimate business. The best course for the buyer to pursue is to exempt the engine builder from all responsibility outside of the machinery itself, even to the painting of it, leaving to him only that which he is prepared to handle.

The data from an actual case may give some ideas of the requirements: Static water pressure at level of engine room floor, static water pressure from floor to level of water in well, allowance added for friction in force main, allowance added for friction in suction pipe, total working load upon plungers, steam pressure at throttle, available clear height above engine room floor, engine room floor to basement floor, vertical, available distance across engine room, wall to wall of engine room, inside, across, available on floor, lengthwise of engine room, available in basement lengthwise of engine room, distance from building wall to pump well, air chamber required at inboard end of suction pipe, and air pump required for force main.

Then it seems to be desirable to state the stopping place on the contractor's part, of the suction, delivery and steam pipes, and in this and other items remove to the utmost extent any and all uncertainties, so that builders of pumping engines may be able to figure upon some exact basis. A general outline of the work to be done, modified of course by conditions in different cases, would call for the making of the design, furnishing general and detailed drawings or blueprints, and erecting in the pumping station, upon foundations to be furnished and built by the buyer, in accordance with the detail blueprints, templates and anchor bolts, furnished by the engine builder, a pumping engine of the desired class or type, together with appurtenances, connections, piping and fixtures within the engine room, complete ready for continuous service.

The methods of determining the capacity of the main pumps vary according to the ideas of the builders and buyers; sometimes a weir only; sometimes a weir in conjunction with the plunger displacement. Mr. Hague has reached the conclusion that with proper pump construction, the plunger displacement is adequate and conclusive, care being taken that the pump valves are reasonably and practically tight under pressure and of a design including their seats, which will place their capability of holding water beyond doubt. When it is realized how much work and carefulness is necessary in constructing and using a suitable weir, the clean-cut, unmistakable performance of multiplying the actual areas of the plungers easily measured, by the length of the stroke also easily and accurately determined, will be found to be much preferable; especially so when it is considered that an excess allowance of say 5 per cent. in plunger area can be provided to make up for possible deficiency at the stated speed of travel, so as to ensure the actual quantity called for.

In the matter of design of a pumping engine, under specifications drawn closely enough to indicate the type desired clearly and unmistakably the actual design may be well left to the builder; the stipulation being made that the engine, if to go into a building already in existence, must conform reasonably to its proposed surroundings, so that proper and convenient space about its various parts may be assured. In the matter of adapting this or that general type of machinery to any particular work or service perhaps the buyer might profit by independent expert advice, so as to guard against the well-meaning but misguided zeal of makers possessed with strong desires of selling machinery which might not possibly represent the very best investment for the buyer, but which might incidentally give its maker and advocate some trifling advantages over competitors in making a contract.

A fairly good general statement of what would be desirable in a pumping engine for most cases, and provided there were no special reasons otherwise, would be about as follows:

To have the steam pistons rigidly and directly connected to the water plungers so that no power would be transmitted through working parts and joints beyond that due to the equalization of the steam distribution.

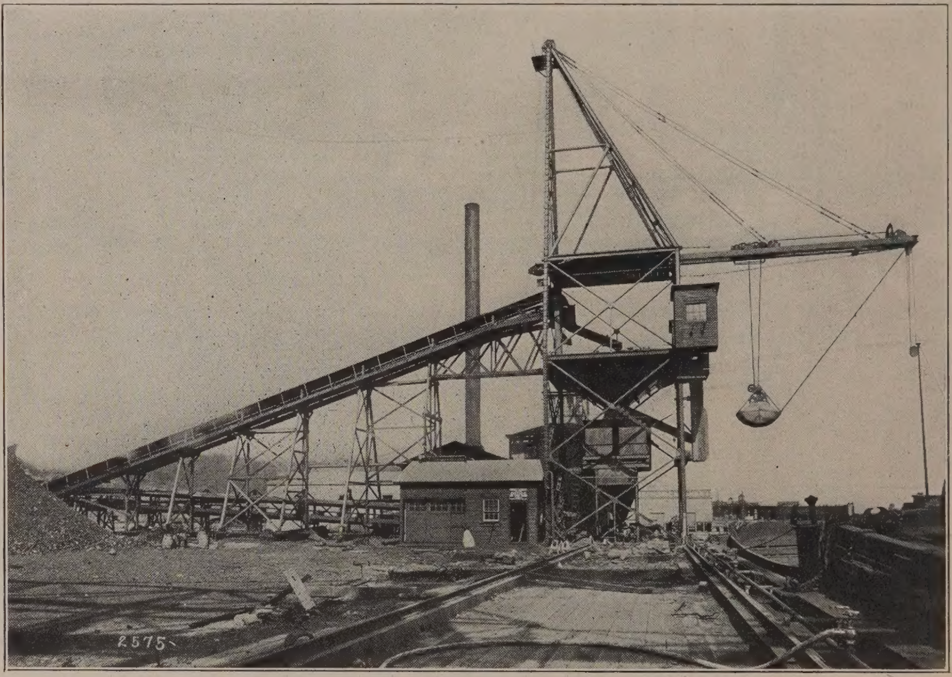
The steam cylinders and the pump cylinders connected and supported so that the engine would be practically self-contained; and have all anchor bolts extend downward far enough into the foundations to obtain the benefit of the weight of the masonry.

There is no good reason for not stating the stroke of the pistons and plungers, and their speed as well, either or both in feet of travel and revolutions per minute, giving the allowance of excess desired in the plunger capacity. Subterfuges relating to percentages of plunger diameter to length of stroke are sometimes indulged in for the purpose of stipulating dimensions, but by far the better way is to come right out with the desired proportions of the water end of the machine, conforming of course to good practice, but leaving the steam factor largely to the builder on account of the duty guarantee generally required. The writer has observed cases wherein it would have been much better to appoint the experts before the buying of the engine than to wait until after completion for the regulation test of the machinery; and for the reason that, even where the designing is left to the builder, certain stipulations covering principles of construction and proportion if properly carried out will ensure the results asked for by the buyer, and all the experts would need to decide would be whether or not these stipulations had actually been met; a test much more readily and decisively accomplished than some of the ends aimed at during tests after construction.

The condenser for the engine comes in of course for some attention, and whether of the jet or surface type depends upon the situation, from where the condenser water is to come, and other considerations applicable to each case by itself. If a jet condenser is used, the injection water should be taken from a point and under conditions which will ensure a solid column of water containing the natural minimum percentage of air. Difficulties have been run into from time to time by attempting to save something in the length of injection pipe, on account of the disturbances and conditions which usually are found in main suction pipes. As a broad principle, the water for a jet condenser should be taken from the main pump well by an independent pipe or pipes for the use of the condenser exclusively; and if this can not be practicably done then the nearest possible approach should be made to such an independent arrangement.

The air pump or pumps with the speed as moderate as a pumping engine, better be driven from the main engine unless there exists some special reason to the contrary; in fact, general economy points to the driving of all auxiliary pumps from the main engine as a broad principle. The question of an exhaust feed water heater between the low pressure and the condenser depends for the most part upon surrounding conditions, but it will generally pay to use such an appliance.

The steam cylinders to be thoroughly steam-jacketed, and all steam distribution valves so designed and located that the steam and exhaust ports are correctly proportioned to cylinder volume and piston speed, affording easy induction and release of the steam with the least friction consistent with minimum clearance. There are examples of close clearance where the waste room in the cylinders has been brought down as low as the following percentages: High-pressure cylinder, 1.4; intermediate cylinder, 0.6; low-pressure cylinder, 0.5. The above clearances are about the lowest known and are found in some of the well-known, three-cylinder, vertical, triple-expansion pumping engines.



The Steeple Tower of the Anthracite Coal Handling System of the New York Edison Co. at Shadyside.

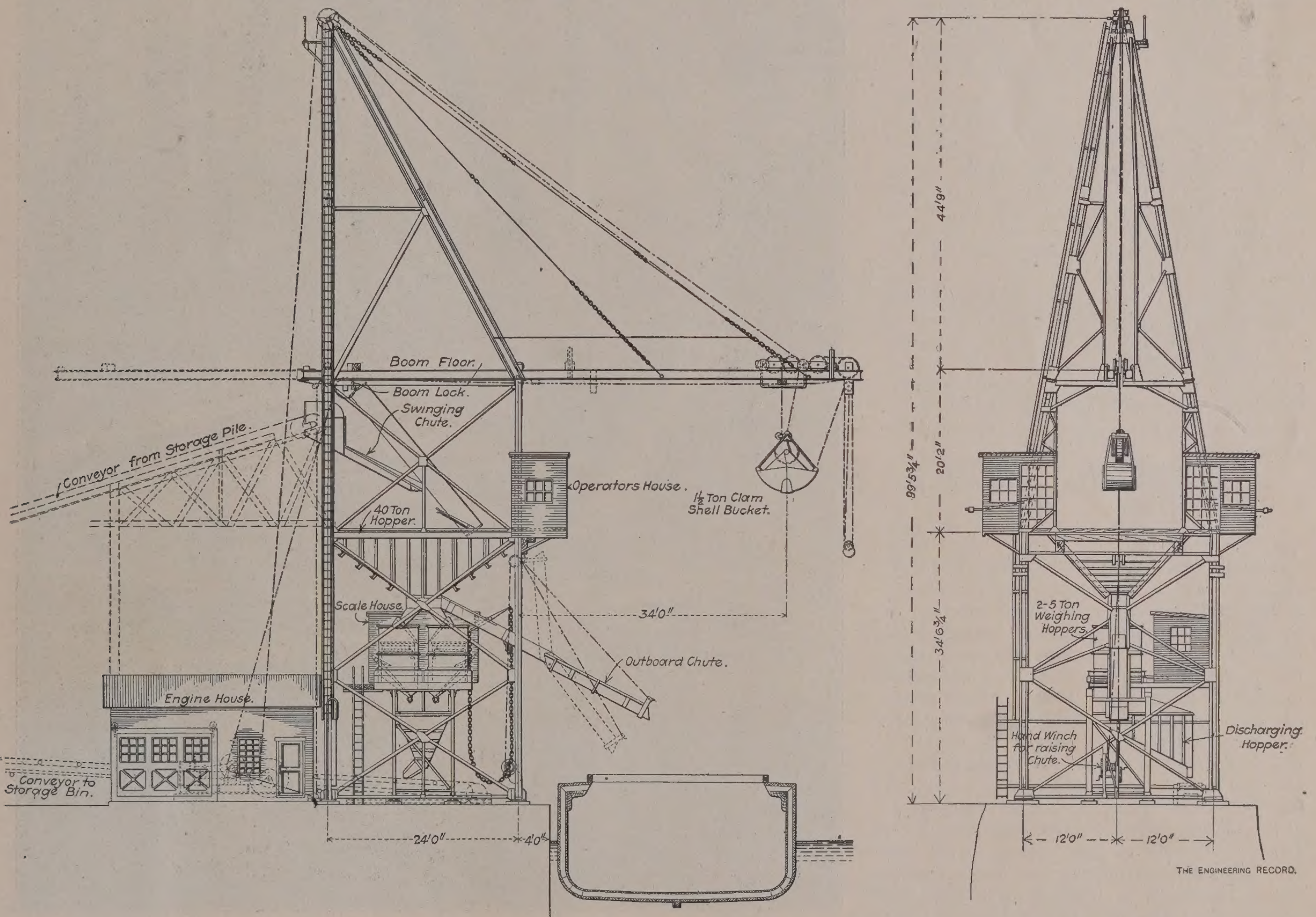
The construction and arrangement of steam jackets so as to prevent or avoid undue strains and tendencies toward leakage, is very important, and it is pretty safe to say that there are few adjuncts of the steam engine requiring so much careful attention and careful thought both by the builder and the operator in proportion to the benefits derived, as the steam jacket; it is really a necessary nuisance. The receivers with heating coils, situated in the track of the steam in transit from cylinder to cylinder, should be of liberal dimensions so as to distort the steam distribution as little as practicable.

The pump valves are of course highly important details, and in general practice have been brought down at the present day to plain rubber discs, rather hard and of moderate size, supported by brass gratings of circular form, with radial ribs to support the centre of the seat. There is, however, a new pump valve just appearing which consists of a corrugated brass or steel diaphragm connecting together an outer and inner narrow ring of rubber or soft metal, so arranged that the radial bars of the valve seats are not touched by any part of the valve, the shut-off being made at the outer and inner circles of the seat by means of the narrow rings; thus entirely eliminating the principal cause of the destruction of pump valves, the bearing upon the radial bars. These valves are not yet enough in evidence to know exactly how they will act in continuous service.

The area of pump valve openings is a subject which has led to many arguments and disputes during the development of pumping machinery; the reference often being made to percentage of plunger area in denoting the aggregate "valve area" of the pump. But the valve area by itself, that is, the number of square inches of opening through the valve seats, will not answer the question in relation to the plunger area. The valve area is a factor of the quantity and really independent of the incidental area of the plunger; and as a matter of fact the flow of the water through the valve seats must not go above a certain velocity if proper operation of the pump is to be retained. Therefore the relation between the quantity of water and the area of the valve seats with a limit of velocity held in view, really controls the aggregate of the openings, and any one who will take the trouble to figure it out will find that it matters not whether we consider a small plunger at a high rate of travel or a large plunger at a slow rate of movement, which means that so long as the quantity per minute and the valve area remain constant the changing of the plunger will matter but little. If we go to talk about valve area in terms of percentage of plunger area, the speed of the plunger must be considered, and this has led the writer to a pretty good rule to govern in such cases; which is to divide the feet traveled by the plunger per minute by two and let the result represent the percentage of the plunger area for the valve seat openings. For example:

Plunger speed per minute in feet.	Percentage of plunger area in the valve seats.
100 feet	50 per cent.
150 feet	75 per cent.
200 feet	100 per cent.
250 feet	125 per cent.
300 feet	150 per cent.

The mechanism pertaining to the steam distributing valves is a most important detail of the engine and should be of great strength and durability, so as to be thoroughly reliable in all its functions and motions, free from failure and derangement. In these days of the use of large poppet valve, both induction and exhaust, on the low-pressure cylinder so as to reduce the clearance of waste room to the lowest possible dimensions for this last cylinder before the steam escapes to the condenser, there seems to be a tendency to make some of the connections too light, apparently with the idea that the work of moving poppet valves, very nearly balanced or at least under very light pressure, is next to nothing. But the comparatively large size and considerable weight of the poppet valves employed, together with the actual lifting and bodily moving such valves and their rods, calls for a stiffness at least to prevent undue tremor and actual breakage.



Details of the Steeple Loading and Unloading Tower, with Weighing Hoppers, for the Anthracite Coal Handling System, New York Edison Co.

The valve motion connections to and from the eccentrics, rock shafts, wrist plates and valve arms should be adjustable for lost motion, and wherever necessary or desirable, also for length The methods for the adjustment of the valve motion pins and bearings should be consistently carried out by means of some kind of solid heads, either of composition or steel, and where expedient or desirable, by means of straps and keys. But all working rod joints should be adjustable for wear by the use of half boxes adjustable by means of set screws, wedges or keys. The radius rods where used should be screwed into the wearing heads by right and left threads provided with jam nuts or the equivalent.

In the older practice many valve stems were made of hard brass, but in these days of high initial pressure, and with the general large increase in dimensions and powers, forged-steel valve stems have come into vogue, protected where necessary by brass sheathing and arranged to drive the valve by strong, adequate and reliable means of contact. The valve stems, whether for the Corliss type or for poppet valves, should be well guided at or near the outer ends in substantial bonnets or brackets, and be provided with competent stuffing boxes. With rolling stems there is probably no objection to proper internal shoulders or collars on the valve stem, but in any event there should be stuffing boxes provided.

The steam distribution valves themselves should be of an extremely reliable type in a pumping engine for water works service and have proper facilities for refitting and adjustment; the engine in most cases being fitted with a variable cut-off mechanism so arranged that it may be easily and promptly manipulated from safe and convenient points while the engine is at work. In the vertical triple expansion machine now so generally favored, the cut-off on the high-pressure cylinder is controlled by an automatic governor, and also adjustable by hand. The intermediate and low pressure cut-offs are adjustable by hand only, and in some cases the low pressure, both cut-off and exhaust, is fixed and not adjustable excepting by changes of a permanent nature.

In drawing up specifications for pumping engines upon the part of the buyer, it is not good practice or policy to go too closely into actual design or even dimensions, but rather set forth the conditions and requirements to a pretty exact degree, and by so doing the competition will be kept within certain restrictions, a good, close and real competition on figures will be obtained, and a great variety of bids on machines, most of which would not be wanted, kept from complicating the efforts to secure the class or type of machine really wanted and best adapted to the work to be done in the current service of the water works plant.

The writer can recall a recent case where in ten or twelve bids from different concerns representing the best manufacturers of pumping machinery in the country, with business headquarters situated hundreds of miles apart, the dimensions given by the bidders for the machinery proposed to be furnished were alike in a large majority of the offers, and even the few which differed from the majority differed but slightly. The bids reduced to equal terms did not vary more than 5 per cent. In the specifications under which all of the proposals were made, not a dimension excepting the length of stroke of the engine was mentioned, but the conditions of service were pinned down so closely that practically all bidders arrived at the same conclusion.

The adaption of a pumping engine to its conditions so far as may be, is the key to highest efficiency under the conditions imposed. There are advocates of high speed, of high steam pressure, of high rate of revolution, and other singled out and isolated factors, but the general combination wherein the machine best meets the conditions is what will yield the best results and not the exploiting of any particular seemingly important factor by itself. And as an example of this fact it may be noted that the pumping engine in this country, if not in the world, which holds the high-duty record has the following conditions to work under:

Capacity per 24 hours, 15,000,000 U. S. gallons; piston speed, 197 feet per minute; rotative speed, 20 revolutions per minute; water load against pumps, 126 lb. pressure; steam pressure per gauge, 126 lb. pressure; indicated power, 802 hp.;

mechanical efficiency, 96 per cent.; steam per hour, I.H.P., 10.68 lb.; duty per 1,000 lbs., steam, 179,454,250 foot lb.

Regarding high-piston speed, the best record known to the writer as to pumping engines is 607 ft. per minute, where the duty per 1,000 lbs. of steam was 157,843,000 foot pounds, showing that higher piston speed alone will not answer.

Regarding high steam pressure the record seems to be 200 lbs. and a duty of 149,500,000 foot pounds, showing that high steam pressure in the absence of other ruling conditions or proper fitness falls short of the best performance.

Regarding thermal efficiency, or the actual economy of heat employed with reference to absolute temperatures, even the greatest thermal efficiency does not in the presence of adverse conditions in some other direction, equal the engine working under the best general fitness of things as will be seen by the following:

Thermal efficiency.	Duty per 1,000 lbs. steam.
22.8 per cent.	149,500,000 foot pounds.
21.63 per cent.	178,497,000 foot pounds.
21 per cent.	179,454,250 foot pounds.
20.85 per cent.	173,620,000 foot puonds.
20.78 per cent.	176,419,600 foot pounds.

What is considered the record for general all-around efficiency for a pumping engine up to date is as follows: Capacity per 24 hours, 30,000,000 U. S. gals; steam pressure gauge, 185 lbs. per sq. in.; piston speed, 195 ft. per minute; duty per 1,000 lbs. steam, 178,497,000 ft.-lbs.; duty per million heat units, 163,925,300 ft.-lbs.; steam per hour, I.H.P., 10,335 lbs.; thermal efficiency, 21.63 per cent.

With reference to the steam economy of the higher type of pumping engines and its repetition in different engines it may be noted that covering a period of more than three years, five pumping engines of a similar type, of different builders, and situated many miles apart, gave steam per indicated horsepower ranging through the following figures:

10.33 pounds per indicated horse power per hour.
10.63 " " " "
10.78 " " " "
11.01 " " " "
11.10 " " " "

It hardly seems probable that materially higher efficiencies will be obtained in the near future at least, and not very much higher efficiency is possible with the steam pressures seemingly practicable to employ in pumping stations; superheat in the steam will no doubt carry the record to slightly higher figures, perhaps to 200,000,000 of foot pounds or a trifle higher, as the reheating and superheating of the receiver by means of coils in the boiler connections of smoke flues will also tend in the same direction; but, of course, net gain is what is sought, and fancy duty figures at the expense of heat in some other part of the plant will not add to real economy in the long run. But, however the steam or heat efficiency may be improved, or however many times the present record may be reached in the future, the durability of the machinery for the purpose of its existence comes first and should not be sacrificed to any fancied betterment in steam economy only.

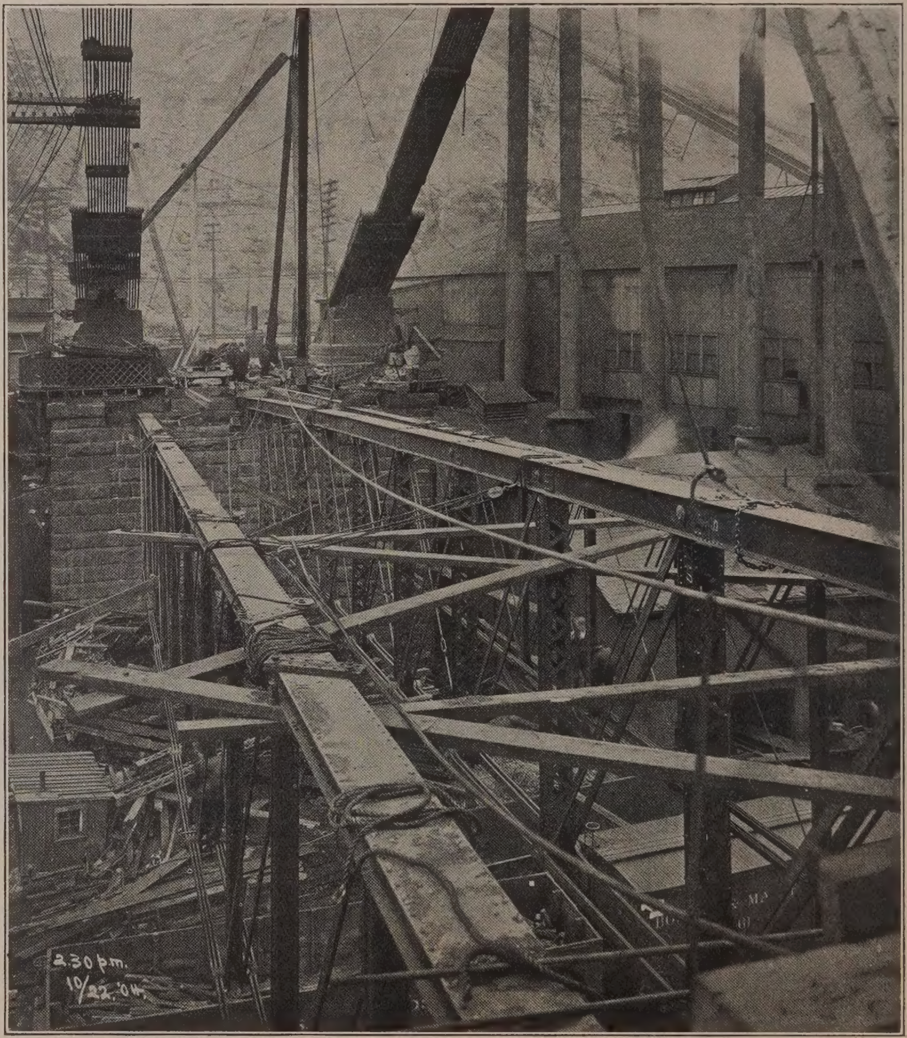
A Ten Weeks' Steam Turbine Record of a 1,500-kw., two-phase Parsons turbo-generator, after the unit had been running for five months at 16 hr. per day and six days a week, during which time the normal load was about 1,000 kw. during the daytime and 1,400 kw. to 1,600 kw. during the dark hours before 11 P. M., is as follows, according to Mr. S. E. Fedden, general manager and engineer of the Sheffield Corporation, in whose Neepsend generation station the unit is one of a pair there installed: The steam pressure was 190 lb.; the superheat 100°; the vacuum 27 in.; the load 979 kw.; and the steam consumption 22.41 lb. per kw.-hour. These figures are given as the average over the period stated.

The Reconstruction of the Point Bridge, Pittsburg.—II.

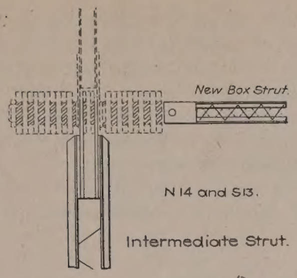
The two 145-ft. deck shore spans of the bridge were entirely rebuilt, except the two main trusses in each. A new truss was added on the center line of the bridge and new lateral and sway bracing and floor were provided. The new trusses were ordinary pin-connected Pratt trusses 15 ft. 10 in. deep and 146½ ft. long on centers, made throughout with 5-in. eyebars and pairs of channels latticed for all tension and compression members, respectively. The web reinforcement plates for the end top chord pins extend 10½ in. below the lower flanges of the chords and receive 4⅞-in. pins, through riveted, fixed and expansion shoes of ordinary construction. The plate girder floorbeams, 34½ ft. long, were made in separate halves seated on the top chords and riveted to them with a clearance between the adjacent ends at the center of the new truss. The sway brace diagonals are 1-in. square soft steel rods upset to 1½-in., with right and left hand screws engaging clevises. This enabled them to be adjusted in the clevises without the use of sleevenuts, which were omitted. The top lateral X-braces are single 3x3-in. angles, with the vertical flanges turned in opposite directions to clear at intersections and having both flanges field-riveted to connection plates shop-riveted to the lower flanges of the floorbeams. The bottom laterals are similar and are field-riveted to connection plates shop-riveted across the lower flanges of the bottom transverse struts.

The street approach at an angle with the north or Pittsburg end of the bridge was enclosed and used for storing the steel work for all three spans. A derrick there unloaded and stored the materials and loaded them on truck cars made to fit the street car gauge, which were hauled to and across the bridge by lines operated by two hoisting engines. The old materials removed from the bridge were delivered to the storage yard by the same system. The old trusses of the approach spans were guyed and the floor and all connecting members except the old floorbeams removed. The floorbeams were shifted to clear the panel points, and on them the top chord for the new truss was assembled on the center line of the bridge by a derrick on the tower and another on the abutment. The same derricks assembled the other members of the truss to the top chord which supported them and after the truss was completed it was jacked up clear of the old floorbeams, and after the latter were removed was lowered to its final position on the abutments.

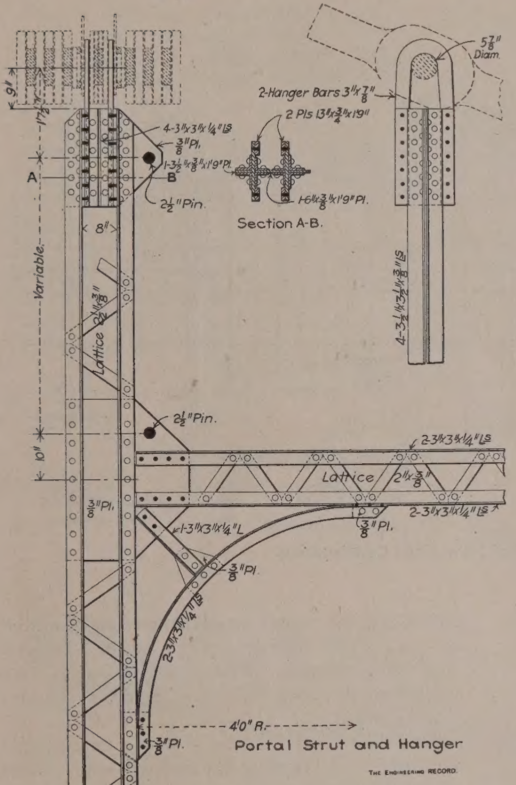
While the anchorage reinforcements were being made the old floorbeams and stringers of the main and approach spans were removed by the aid of tackles suspended from the suspension chains and operated by hoisting engines at the towers, and the new floor of the main span was then assembled by the same apparatus. The center span floorbeams are plate birders 32 ft. 4 in. long and 33 in. deep, web connected through double web cover plates to the new riveted hangers which support the floor from the suspension chains, as shown in the half sectional elevation. The floorbeams carry four lines of 15-in. I-beam stringers, every fifth one of which has an expansion connection at one end to correspond with



Erection of New Center Truss in Approach Span.

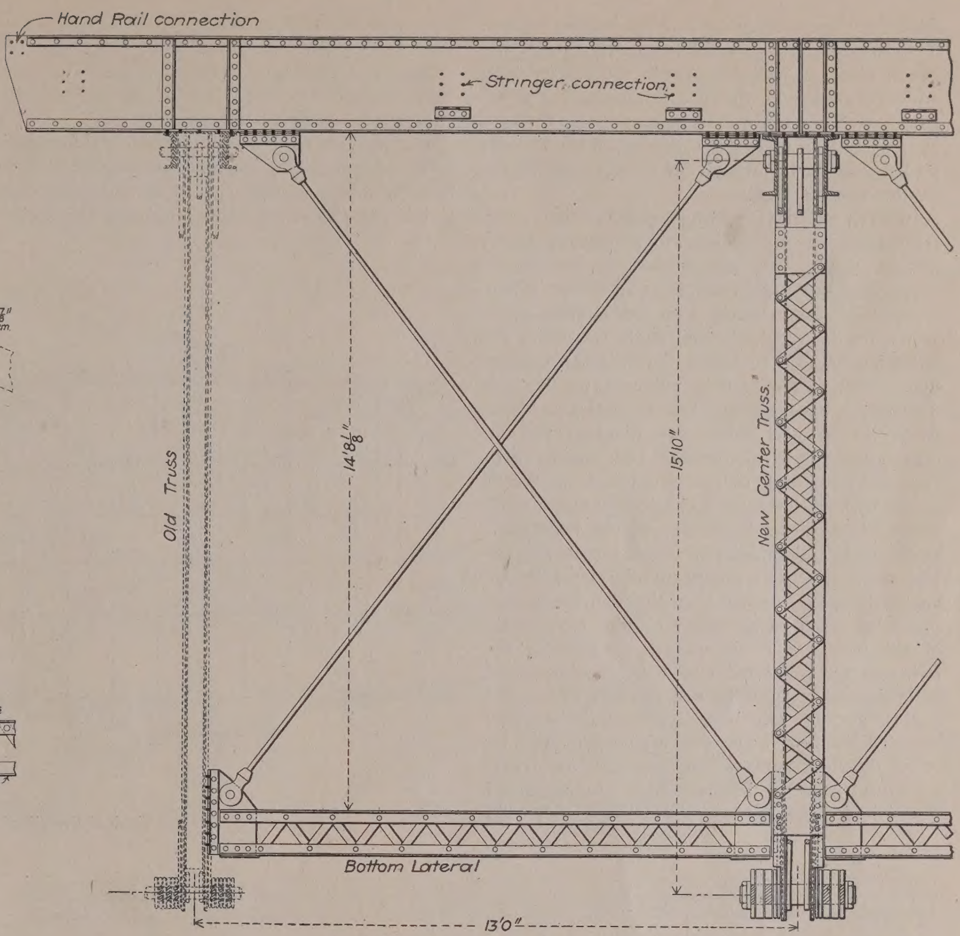


Intermediate Strut.



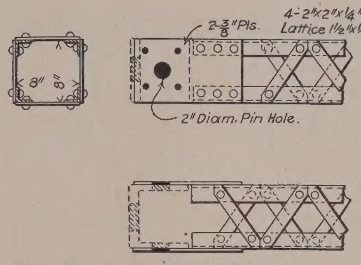
Portal Strut and Hanger

THE ENGINEERING RECORD.



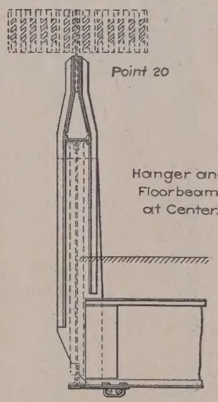
Half Section of Deck Approach Span

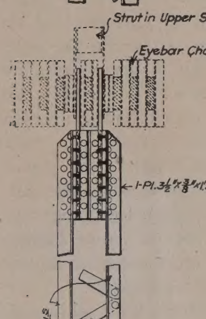
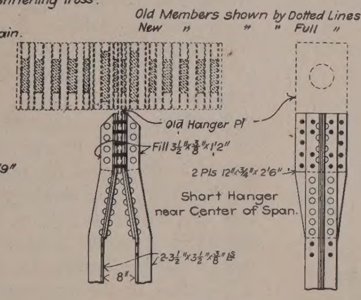
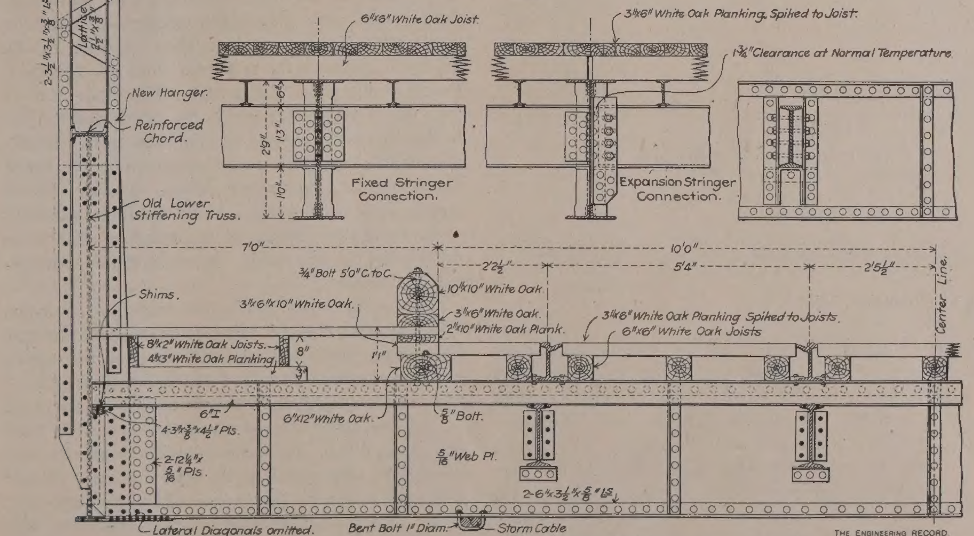
THE ENGINEERING RECORD.



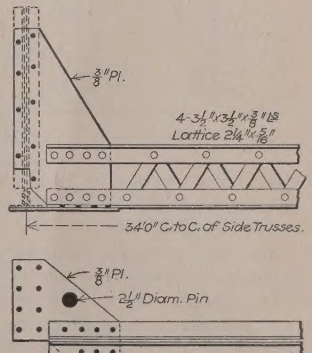
Upper Transverse Strut 13, 14, 17.

THE ENGINEERING RECORD.



Typical Part Cross-Section.

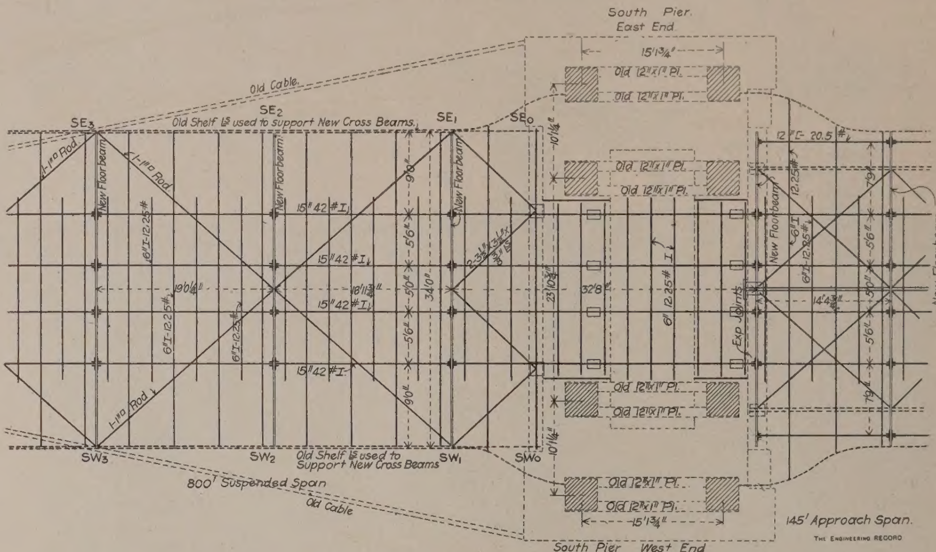


Lower Transverse Strut at Expansion Point.

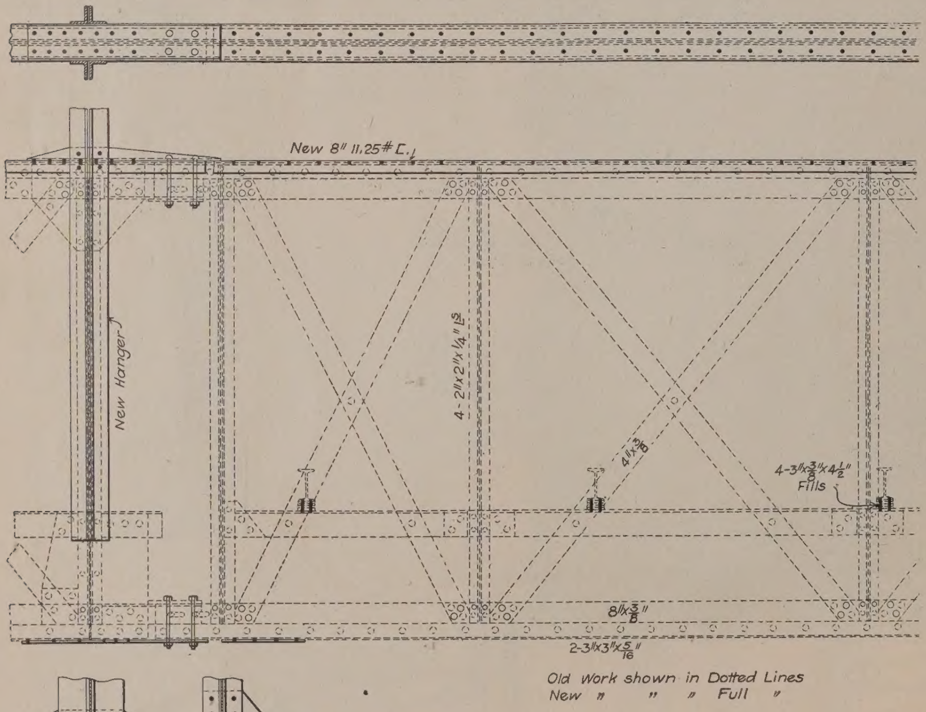
NEW MEMBERS IN MAIN AND SHORE SPANS, POINT BRIDGE, PITTSBURG.

the expansion joints in the lower stiffening trusses. The sliding ends of the stringers rest on horizontal plates in pockets between the vertical web stiffener angles of the floorbeams, and are secured by four horizontal bolts passing through slotted holes in their webs, through filler castings on both sides and through the outstanding flanges of the vertical angles.

In each panel the stringers carry eight 6-in. transverse I-beams, which are alternately 16 ft. and 32 ft. 4 in. long, the ends of the long beams supporting only the sidewalk platforms. Their extremities take bearing on adjustable shims seated on the old horizontal angle riveted to the stiffening trusses to carry the original wooden floor joists. The panels adjacent to the end floorbeams have zig-zag lateral angles as indicated in the part floor plan diagram and all other panels have intersecting 1-in. square diagonal rods reaching across two panels and connected with separate pins to horizontal plates shop-riveted to the bottom flanges of the floorbeams at the ends and middles of alternate floorbeams. The floor system is practically the same in the approach spans, except that the floorbeams are supported as already stated on the top chords of the trusses and the expansion ends of the stringers are supported wholly by the horizontal bolts through their webs and through the pocket angles, and do not have shelf angle bearings. Between the towers the pier masonry is 30¾ in. below the floor surface, and supports the stringers and transverse beams, which are continued across it for the roadway platform. Under the towers and outside of them the sidewalk floor is carried on 8x12-in. wooden joists laid directly on the masonry.



Typical Panels of New Floor Construction.



Lower Stiffening Truss at Expansion Point.

The old stiffening trusses are field-riveted through the flanges of their vertical angles at every panel to the web plates of the new hangers, and they are stiffened transversely by the horizontal lateral connection plates field-riveted to their lower flange angles and to the flanges of the floorbeams. The top flanges were reinforced by field-rivetng to them an 8-in. horizontal channel with the flanges down. The web members of the trusses were cut loose at one end, the holes reamed and they were riveted up again to make them straight and true and conformable to the adjustments of the new hangers.

The hangers have I-shape cross sections made with two pairs of 3½x3½x⅜-in. angles back to back, latticed and field-riveted at the upper ends to the old connection plates engaging the eyebar pins. At portal points there were no old hanger plates, and the hangers are connected to pairs of 3x¼-in. U-bars slipped over the pins between the eyebars. At two panel points new transverse struts were provided where none had existed before, and were connected to the ends of the eyebar pins, as shown in the detail at points *N* 14 and *S* 13. At the center of the span there are no overhead transverse struts and the hanger angles are bent at the upper end and connected to the old hanger plates, as shown in the detail at point 20. Seven new bottom transverse struts at expansion points have been made, and field-riveted to the bottom flanges and vertical angles of the stiffening trusses, as shown in the detail of the end of a strut. The panels between opposite hangers were braced with top and bottom horizontal transverse struts in all cases except at the center of the span, and as the heights increased one or two intermediate struts were added and the panels between them all X-braced by 1-in. clevis rods like those in the approach span sway bracing. The transverse struts are riveted to the hangers, except in the cases previously noted.

The lower ends of the tower columns were reinforced by riveting full-width ⅜-in. plates about 3 ft. long to each web. The lower edges of these plates were planed to take bearing on the projecting cast-iron base plates and the rivet holes were drilled ⅛ in. high to draw the plate to firm bearing at the bottom. To replace the 12x1-in. horizontal plates, which had connected the column bases, transverse girders with their ⅜-in. web plates in vertical longitudinal planes were riveted across the outside faces of the columns. They have single 3x3½-in. top flange angles and single 5x3x¾-in. bottom flange angles, the latter carefully bedded on the pier masonry with Portland cement mortar or grout.

The deck of the bridge is built with white oak timbers and deck planks thoroughly bolted to the steelwork. There are four lines of 9-in. 137-lb. grooved girder rails and two lines of 10x10-in. guard timbers on the curbs. The floor timber was delivered by barges at the north end of the bridge, hoisted by a 300-ft. cableway trolley reaching from the north tower to a point on shore about 100 ft. up-stream, where it was cut to length and framed by a small portable sawmill, and afterwards delivered to different points on the bridge by the cable system installed for the material yard.

Besides the work above described the contractors replaced the old hand rail, adjusted the old transverse struts and the members of the upper stiffening trusses, provided new splice plates, drove new rivets and cleaned the ironwork of all parts of the old structure, removed the rust with wire brushes, filled depressions with cement and painted all the metal work with one coat of red lead and oil and two coats of white lead and zinc. They also cleaned and pointed the old masonry, repaved the approaches and laid granolithic sidewalks at the south end. It is considered that the appearance of the bridge is much improved by the revision of the floor grades so as to give a uniform camber curve, by the heavier and stronger appearance of the riveted hangers, and by the substitution of ornamental sheet metal domes for the former light grill work on the tower tops. About 180 tons of old iron was removed from the bridge and 655 tons of new steel was added, including 147 tons in the anchorage chain, grillages and toggle connections. About 5,000 cu. yd. of concrete was put in the new anchorages. Reconstruction was commenced June 1, 1904, and the completed bridge was opened for traffic November 28, 1904.

The work was executed under the direction of the Department of Public Works of Pittsburg, Mr. E. M. Bigelow, director; Mr. A. W. Burke, superintendent of the bureau of construction, and Mr. Willis Whited, assistant engineer in direct charge. The general contract was awarded to the Pittsburg Construction Co., Diamond Bank Building, Pittsburg, Mr. C. L. McKenzie, president. Mr. Lee Trower, superintendent of steel erection, and Mr. M. H. Rankin, superintendent of masonry and timber construction. A sub-contract was let to the McClintic-Marshall Co. for the fabrication of the steelwork, except the ornamental work, which was let direct to W. N. Kratzer & Co., Pittsburg, on their own competitive designs.

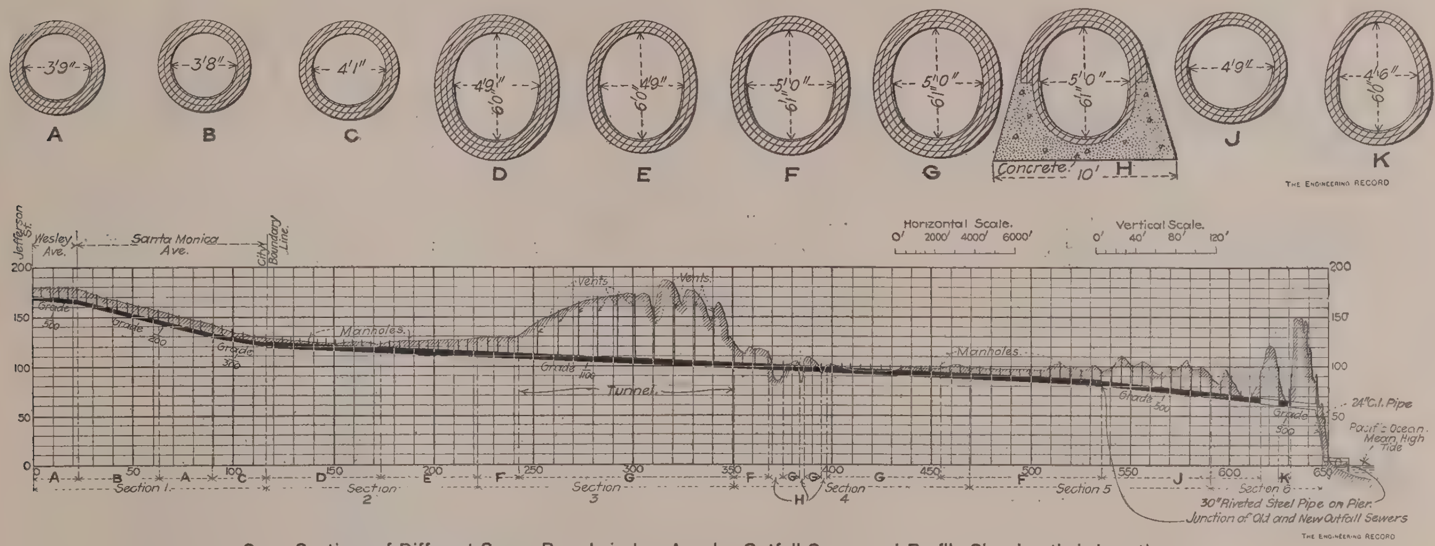
The eyebars were made by the Phœnix Bridge Co. The total cost of the repairs and reconstruction was about $120,000, and it was estimated that it would have cost about $750,000 to replace the old bridge with a new one of equal capacity.

DETERIORATION OF MINE-CAR COUPLINGS was discussed by Mr. W. H. Finley in a paper before the Engineering Association of the South. Much trouble was experienced in the breaking of mine-car hitchings at the mines of New Soddy Coal Co., at Soddy, Tenn., due to apparent crystallization of the metal, a serious wreck occurring from the breaking of a 1⅛-in. wrought-iron pin without apparent cause. Upon annealing the broken pin its crystalline structure gave way to the original fibrous character and its strength returned. An investigation showed that the peculiar service to which the mine hitchings are subjected crystallizes the parts so that in a short time they become sufficiently brittle to break with the slightest shock. This has been entirely remedied by frequently annealing these parts by thoroughly heating in a pile covered by a wood fire which is allowed to burn itself out and gradually cool.

The New Outfall Sewer at Los Angeles.

A new outfall sewer, which begins near the west boundary line of the city and extends to an outlet in the Pacific Ocean, is now being constructed at Los Angeles, Cal. It will replace the existing outfall which has been in service since 1893, and has been designed to produce higher and more uniform velocities than exist in the present structure, through which, owing to the inverted siphons in it and to its great length, sewage now requires about 24 hr. to pass. As the climate at Los Angeles is uniformly temperate, the low velocities at which the sewage now flows and the amount of time required for it to reach the outlet, together with the action of the anaerobic bacteria in the siphons, causes it to be considerably decomposed, with the generation of a large amount of offensive gases, before it is discharged. The flat gradients also resulted in the formation of deposits at various places.

On account of these and other defects in the present sewer, Mr. Harry F. Stafford, city engineer of Los Angeles, decided to build an entirely new outfall with a more direct route and uniform grade. The new outfall has a total length of 66,000 ft. from the point where it joins the sewerage system to its outlet, as compared with a length of about 62,000 ft. in the old sewer between the same points. It has, however, a minimum grade of 1 in 1,100 on a 5-ft. by 6-ft. 1-in. elliptical section, as compared with a minimum hydraulic grade of 1 in 800 on a 3-ft. circular section through two long inverted siphons in the latter. The grades on which the new sewer is being laid are also much more uniform than those on the old one. This difference in grades has been calculated to reduce the time of passage of the sewage from the beginning of the outfall to the outlet by 20 hr., and to greatly reduce the liability of the formation of deposits.



Cross-Sections of Different Sewer Barrels in Los Angeles Outfall Sewer and Profile Showing their Locations.

Ventilating manholes are being placed from 440 to 510 ft. apart on about 75 per cent. of the length of the new outfall. On a large part of the remainder, which is in tunnel, ventilating shafts are placed every 1,000 ft., while on the balance, where the excavation is deep, and for other reasons, manholes will be placed from 600 to 800 ft. apart.

Several different standard sections are designed to meet the various conditions which are encountered at different points in the route. The typical sections and the lengths in which they are placed are shown in an accompanying illustration. Brick laid in Portland cement mortar in the usual manner are used in the sewer barrel throughout the work, and where the foundation is good they are laid directly upon it. Where poor foundations occur, or the sewer is laid through filled ground, a concrete cradle is brought up to the springing line of the arch. The inner surface of the invert the length of the sewers is to be coated with ½-in. of cement plaster brought to a smooth, even surface. The extrados of the arch is covered with ½ in. of 1:3 cement mortar and in case it is considered necessary provision has been made to introduce waterproofing between the rings of brick at any point.

The new outfall follows a different route from that followed by the present one from their common starting point to within a mile of the outlet, and from there will be laid on practically the same line occupied by the present outfall. The first 2 miles of it are circular in section, varying from 3 ft. 8 in. to 4 ft. 1 in. in diameter, the grades varying in this length from 1 in 200 to 1 in 500. At the end of the first 2 miles a 1 in 1,100 grade begins, which is continued without a break for almost 8 miles, and in the remainder of the distance the grade is broken but once, and then from 1 in 500 to 1 in 800. The sewer barrel from the beginning of the 1 in 1,100 grade to the outlet, with the exception of one short length, was made elliptical instead of circular in section, chiefly for ease of inspection.

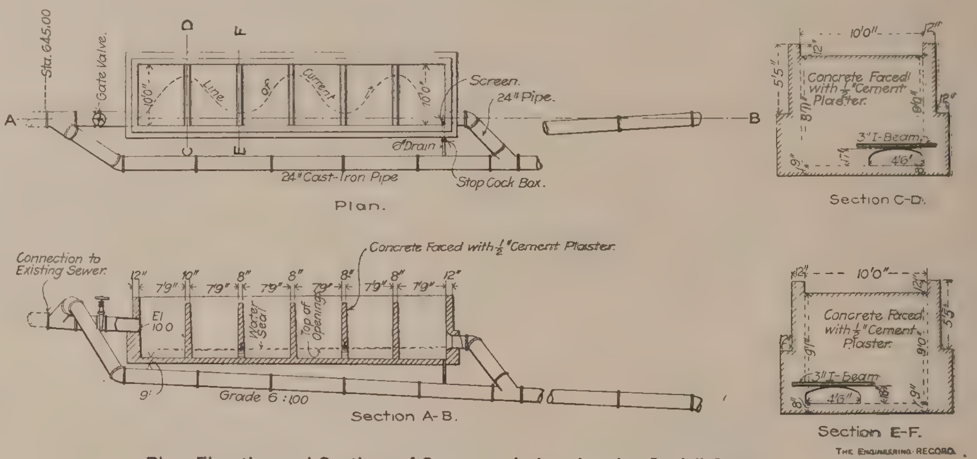
The upper 4.6 miles are to be built in open trench and present no unusual difficulties in their construction. A short distance from its upper end the outfall crosses a narrow-gauge railroad right of way, and in order to avoid breaking the grade and at the same time keep it within the required minimum, the top of the sewer arch is brought within 1 ft. of the top of the rails in the track. The sewer barrel is placed on a heavy concrete cradle, and the arch ring is considerably increased in thickness for a short length at this point to provide for the unusual load.

At the end of the open trench construction is carried for 10,750 ft. in a tunnel, with the sewer invert from 20 to 100 ft. below the ground surface. The soil to be encountered in the path of this tunnel was shown by borings, sunk about 1,000 ft. apart on the line, to be largely yellow clay and gravel, with more or less water throughout its length. The excavation has already been carried 4,000 ft. from the lower end of the tunnel, and the material met thus far has been a heavy moist sand, weighing at least 3,500 lb. per cubic yard, and some difficulty has been experienced in timbering this section so as to hold the sand in place.

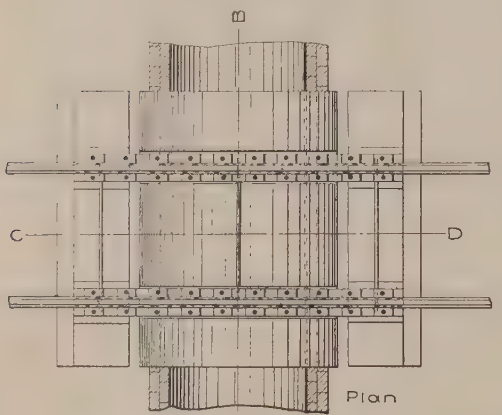
The timbering consists of 6x6-in. sills and uprights in the bents, which are spaced 4 ft. apart, and support 6x8-in. caps, with 2 in. reinforcements, making them virtually 8x10 in. The lagging is 2-in. planking. The weight of the material to be supported by the timbering is so great that in some cases the bents have been doubled up and even then the sills become badly bowed. Two cave-ins, aggregating about 800 ft. long, have been occasioned by the unusually heavy rains which have occurred this season in Los Angeles.

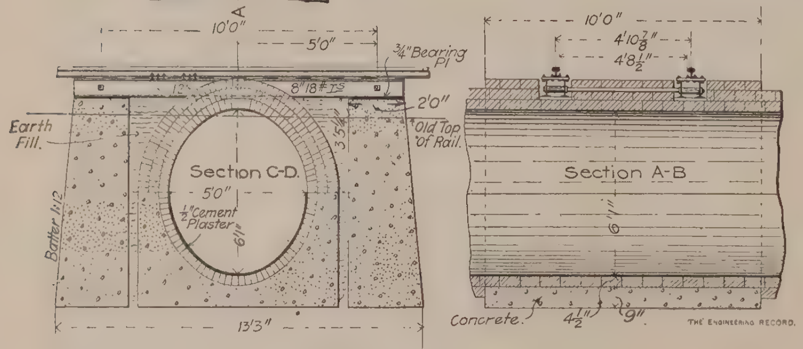
Shafts are sunk 1,000 ft. apart along the line of the tunnel, and headings carried forward from each face. Each shaft is equipped with a hoisting cage in which the spoil and construction materials are handled. No water has been encountered thus far in the tunnel.

There are 10 ventilator shafts provided for the part of the outfall in this tunnel. Before the tunnel work was started a driven well, cased with 15-in. steel pipe, was sunk to a point below the grade line of the sewer at the site of each ventilator shaft and the casing extended 3 ft. above the ground surface. As the tunnel reaches each of these wells the casing is cut off about a foot above the extrados of the sewer arch. A section of 12-in. vitrified sewer pipe is then carefully centered in line with the casing, with a slight space between their adjacent ends, and the arch built around it, as shown in the accompanying illustration. The cast-iron saddle shown is centered on the extrados of the arch under the steel casing, and a ¼-in. lead gasket placed on the shoulder of the saddle. A lining of sewer pipe with special joints is then lowered from the top of the casing until it rests on the gasket. This lining is carried up to the mouth of the ventilator.

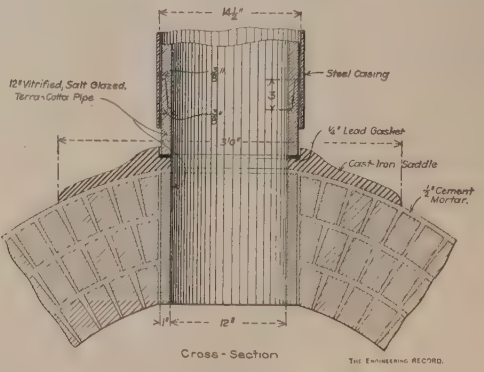


Plan, Elevation and Sections of Separator in Los Angeles Outfall Sewer.





Details of a Railroad Crossing with Limited Head Room.



Connection between Sewer Barrel and Ventilating Shaft.

For about 9,000 ft. from the lower portal of the tunnel the ground is largely at or below the elevation of the invert of the sewer barrel, and a large amount of filling is required to provide the minimum covering of 3 ft. of earth. This filling is placed in 9-in. layers, deposited from wheel scrapers or wagons, and is brought up with side slopes of 2:1 until the top width is 6 ft. In some places where the natural ground surface is considerably below the sewer invert a heavy concrete base is provided for the sewer barrel. The line of the sewer closely parallels a railroad track for a part of this distance, and in the length included in the fill three rings of brick are used in the sewer barrel instead of two, as in most of the remainder of the work not in tunnel.

In the mile and a half from the end of the fill to the point where the lines of the old and new sewers meet and continue along the same route, the work is largely open trench excavation of ordinary character. The old sewer will be torn out and rebuilt, largely with new material from the junction to the outlet, with the exception of one length of about 900 ft., and another of 1,300 ft., which are in tunnel. The interior of the brick work in these sections will be carefully cleaned, each joint dug out to hard mortar and all loose brick removed, and then a half-inch coat of cement plaster applied to the entire surface. The sewage flow will be diverted by broad irigation while this work is in progress.

The brick sewer barrel terminates in a 24-in. cast-iron pipe near the edge of the cliff overlooking the ocean. A 10x50-ft. open concrete tank, 9 ft. deep at its upper end and 10 ft. deep at its lower end, is inserted near the upper end of the 24-in. pipe to assist in separating floating materials from the sewage and thus prevent their passage into the sea. Five transverse baffle walls, with semi-elliptical openings 17 in. high, extending about half their width at the bottom, are placed at equal distances apart in the tank. The openings are placed on alternate sides in the successive walls, and the sewage is introduced at one corner about 3 ft. above the bottom of the tank in such a manner as to cause it to follow a sinuous course in passing through the openings to reach the outlet at the lower end. Floating materials will thus be afforded an opportunity to rise to the surface, and heavy materials will be deposited on the bottom of the tank, which is arranged with a by-pass in order that it may be cut out of service and cleaned.

The 24-in. cast-iron pipe drops 50 ft. in a horizontal distance of 15 ft., and terminates in a 30-in. riveted steel pipe at the edge of the seashore. The riveted steel pipe is laid on a pier extending 1,000 ft. out into sea, and has its outer end about 2 ft. below mean low tide.

The city owns a strip of ground from ¼ to ½ mile wide, extending along the coast for about half a mile on either side of the outlet, and the solid materials in the sewage are so thoroughly disseminated in the long journey through the outfall and distributed by the tides that they cause no accumulations on the adjacent shores.

The cement used in the mortar and concrete is Standard Portland, and is required to pass the tests recommended by the American Society of Civil Engineers, as well as the ordinary boiling test. The brick used are required to pass a 10 per cent. absorption test. It is estimated that 24,000 bbl. of cement and 18,000,000 brick will be required to complete the sewer, which the city furnishes to the line of the work. The contract price of the work on the outfall sewer in addition to the cost of these materials is $565,000.

The work is now being carried on as rapidly as possible, and according to the contract will be completed Sept. 1. The designs of the different structures of the outfall were made under the direct supervision of Mr. Harry F. Stafford, city engineer of Los Angeles, and the construction is being carried on under his direction. The contract, although divided into 6 sections, was all awarded to Mr. S. J. Edwards, of Pasadena, Cal., and assigned by him to Stansbury & Powell, of Los Angeles.

Reforestation of the Waste Lands of the Delaware & Western Ry. in New York State is being taken up by the railroad according to the plans of the State forester.

Tests on Reinforced Concrete Beams.

Abstract of a paper by Prof. W. Kendrick Hatt, to be published in the "The Engineering Review" of the Engineering Societies of Purdue University.

This article records the results of tests made on 47 reinforced concrete beams during 1902-4 by students at Purdue University, discusses the relative flexibility of plain and reinforced concrete beams in relation to these and other recorded tests, and quotes empirical formulæ for the strength of the beams. Fourteen of these beams were reported to the American Society for Testing Materials in 1902. The remainder of the beams were tested during the succeeding years in the Laboratory for Testing Materials of Purdue University.

The Beams.—The beams were generally made of 1:2:4 concrete, with a few of 1:5 gravel (Table I). The cement was partly Peninsular and partly Giant Portland. The sand was excellent pit sand (33 per cent. voids), and the broken stone was Kankakee limestone (43.7 per cent. voids). The entire product of the crusher below one inch was used. There was considerable crusher dust in the stone. The gravel was excellent pit gravel, containing sand and pebbles (20 per cent. voids). The beams were made of somewhat dry concrete, and well rammed until the mass was plastic and water flushed to the surface. The metal reinforcement was partly steel and partly wrought iron, having elastic limits of 33,000 and 36,000 lb. per square inch, respectively.

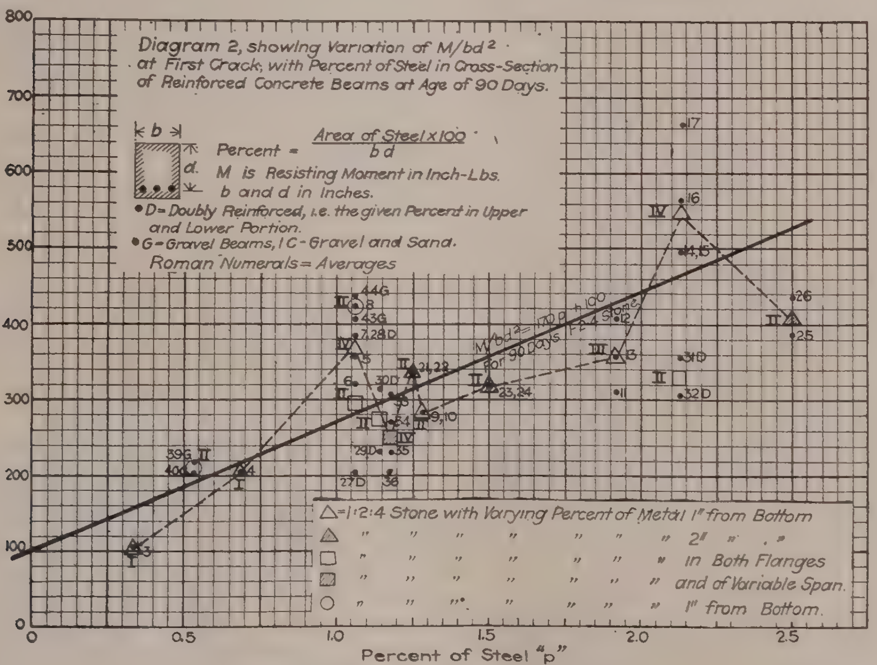


Diagram Showing Conditions at First Crack.

TABLE I.—PROPERTIES OF CONCRETE.

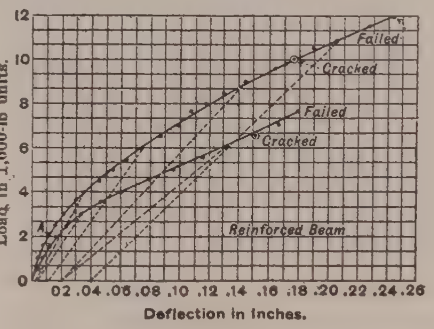
Kind of concrete.							Ultimate strength.	
Cement.	Sand.	Broken Stone.	Gravel.	Age.	Compression Modulus.	Tension Modulus.	Comp.	Tens.
1	2*	5	..	90 da.	4,610,000	5,460,000	2513	359
1	2*	5	..	28 da.	3,350,000	3,800,000	2067	237
1	..	...	5**	90 da.	4,800,000	4,510,000	2804	290
1	..	..	5**	28 da.	3,790,000	4,320,000	2239	253

*Part 1-1. 6-5. **Part 1-6.

Tests.—The beams were simply supported at the ends and tested on a span of 80 in. on a center load. The loads and accompanying deflections were noted, and the loads were released at intervals to obtain the set. The normal character of the curve thus obtained is shown by a typical curve. In 1902 when these tests were made, the writer attempted, without success, to obtain satisfactory measurements to locate the neutral axis of the beams, and at that time was not able to explain the reasons for the characteristic features of this curve. In discussing these tests, Mr. Edwin Thacher suggested that the tensile resistance of the concrete had become zero near the point A. The significance of the various characteristic points of this curve has recently been shown by Professors A. N. Talbot and F. E. Turneaure, who measured the deformations at the top and the extensions at the bottom of a series of reinforced concrete beams. In describing the characteristics of this curve, the writer will take advantage of the information supplied in the papers of these gentlemen.

It will be noted that the stages of flexure are four:

(1) Up to the point called "the point A" the deflections are fairly in proportion to the load. Beyond this point A, the deflections increase more rapidly than the load. Prof. Turneaure has shown that at about the point A very fine microscopic cracks, as shown by water marks on a wet beam, begin to form. Prof. Talbot has shown that at this point the steel suddenly takes on an increased stress. The extension of the steel at the point A is about 12 parts in 100,000, as shown by Prof. Talbot's and Prof. Turneaure's tests, corresponding to a stress of 3,600 lb. per sq. in., on a basis of 30,000,000 lb. per sq. in. for the modulus of elasticity of the steel. Up to the point A the concrete carries stress in tension.



(2) Beyond the point A is what Prof. Talbot calls the readjustment stage, in which the load is thrown from the concrete in tension to the steel, due to the action of these small cracks, which are not visible to the naked eye.

(3) After the readjustment stage the increments in the deformation of the steel are closely proportioned to the increments of the load applied. After a load which, according to the writer's tests, is about 3⅓ times the load at point A, and after a deflection which is nearly six times that at point A, a crack—called "the first crack"—was visible to the naked eye of the observers specially stationed to observe such cracks. Other cracks were later formed at other sections.

Table II exhibits the relation between the point A and the first visible crack.

TABLE II.—TABLE OF FIRST VISIBLE CRACK TO POINT A.

		Ratio of load at first crack to load at point A.			Ratio of deflection at first crack to deflection at point A.		
Reference.	No.	Av.	Max.	Min.	Av.	Max.	Min.
Tablot	19	2.17	4.08	1.20	4.84	9.29	1.38
Turneaure ...	8	1.65	2.14	1.06	2.59	4.46	1,17
Hatt	18	3.36	6.11	1.87	6.04	8.90	2.90

Concerning the stress in the steel at the point of first crack, it may be said that in Prof. Turneaure's tests (on 1:2:4 concrete) this crack appeared at an extension in the concrete of about three times that at the point A, and in Prof. Talbot's tests (on 1:3:6 concrete) at an extension of about 5.7 times that at point A, indicating in the former case a stress in the steel of 12,000 to 16,000 lb. per sq. in., and in the latter case a stress on the steel of 23,000 lb. per sq. in. These fine cracks, it may be noted, close up when the load is removed, and cannot enlarge to a serious extent until the steel reaches its elastic limit. A comparison of the deflection of plain beams at rupture with the deflection at first visible crack of reinforced beams is given in Table III.

TABLE III.—RATIO OF DEFLECTION OF PLAIN AND REINFORCED BEAMS.

Reference.	Average.	Maximum.	Minimum.
Talbot	9.5	23.4	3.3
Turneaure	5.4	8.2	3.2

(4) At a load which is about four times the load at point A, and at a deflection which is about 9 times the deflection at point A, as based on the writer's tests, the beams refuse to carry any additional load. The steel has passed its yield point and the cracks are wide open and will not close upon the removal of the load. The values of four and nine above mentioned become 4.3 and 16 in Prof. Talbot's tests; and 3.5 and 9 in Prof. Turneaure's tests.

It appears from Prof. Talbot's tests that when soft steel of about 33,000 lb. elastic limit is used, up to the extent of 1½ per cent., the reaction of the steel is not sufficient to develop the crushing strength of the concrete. In the writer's tests of beams under a center load, 2½ per cent. of steel failed to develop the crushing strength of the concrete.

It is evident that the range between the point A and the first crack will depend very largely on the quality of the concrete, and on its age. The poorer the concrete, and the older and dryer the concrete the more nearly the first crack will be to the point A.

The results of the tests of these 47 beams are shown in Table IV, in which are quoted the average ratio of load and deflection at first crack and ultimate strength. A comparison of the steel is quoted, both on the actual cross section and also on the area of the cross section above the steel, the latter being the common basis.

Relative Flexibility of Plain and Reinforced Beams.—A sufficient number of plain concrete beams was not tested to supply an extended basis of comparison. The writer's tests, combined with those of Prof. Talbot and Prof. Turneaure, show the plain beams crack and break at a point corresponding to the point A. In other words, fine cracks appear at the same stage of flexure in both plain and reinforced concrete beams. Some writers have held this to be a refutation of Considère's thesis that reinforced concrete may extend at least ten times as far as plain concrete without cracking. It is, however, a question of the significance of the term crack. As far as this relates to the danger to, or unsightliness in, a large structure, due to the presence of the crack, we may disregard these microscopic cracks, which certainly exist in the concrete, and we may fix on the first crack visible to the naked eye as the ultimate practical flexibility of a beam. Since in beams 1 to 18 this visible crack occurs on an average at a deflection six times that of the point A, the value ranging from 8.9 to 2.9, Considère's statement is practically true. He himself discusses the existence of these fine cracks. The relation of the flexibility of plain beams at rupture to reinforced beams at rupture (Table III) also throws additional light on the practical significance of Considère's thesis.

The lesson to draw from these facts is, in the writer's opinion, not that the steel in reinforced concrete beams must be stressed below the point A, but that the computation of the moment of resistance of the concrete beam beyond the point A must not include the tensile resistance of the concrete. The only function of the concrete below the steel beyond the point A is to protect the steel from rust.

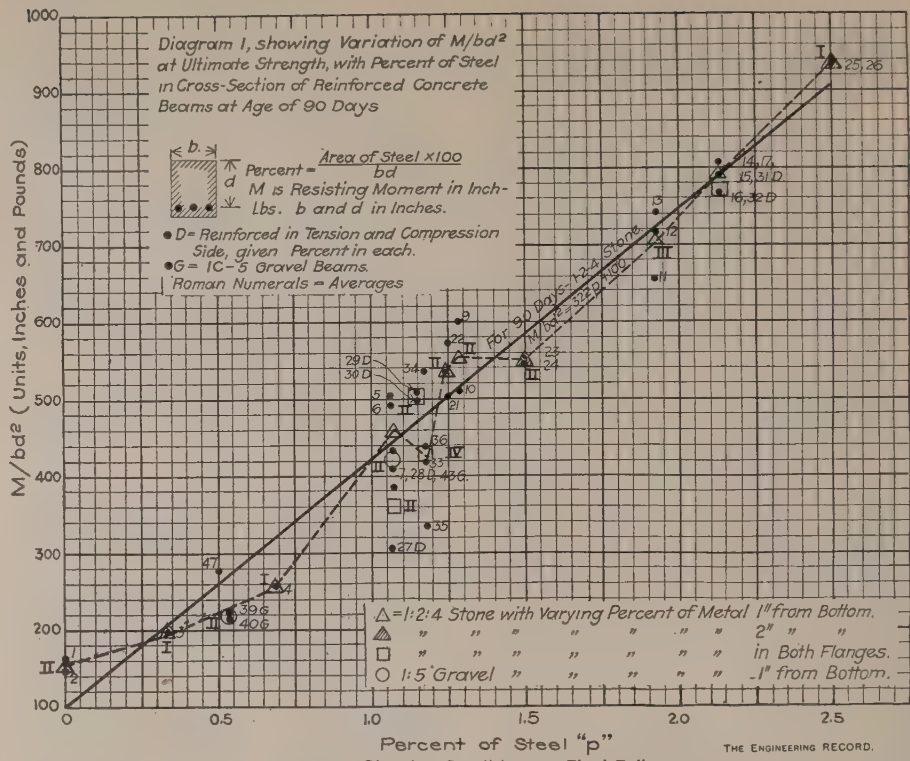


Diagram Showing Conditions at Final Failure.

This discussion has a bearing on the safe unit stress to allow on steel reinforcement by designers. Accepting Prof. Talbot's and Prof. Turneaure's measurements, it appears that on the average the point A corresponds to the stress in the steel of from about 3,000 to 5,000 lb. per sq. in., and that the first visible crack will not appear until a stress has been reached of from 12,000 lb. in Prof. Turneaure's tests to 23,000 lb. per sq. in. in Prof. Talbot's tests. The writer estimates the stress to be 27,000 lb. at the first crack in the beams tested by him. The greater flexibility may be due to a richer mixture, as there was considerable percentage of crusher dust in the concrete. The dust is known to improve concrete. A proposition to confine the stress in the steel to less than 3,000 lb. per sq. in. is unjustifiable, and it would seem the part of conservative designing to use unit stresses at least as high as 12,000 lb. per sq. in. Further experimental study is needed to determine if this unit value can be increased when the concrete is specially prepared for the purpose. It may be urged that many structures, in which the steel has been designed to carry 16,000 lb. per sq. in., are giving good service and not showing cracks.

Table IV.—Results of Tests of Reinforced Concrete Beams at Purdue University.

All beams were 8x8 in. in cross-section and 80 in. long except Nos. 33 and 34, 60 in.; Nos 35 and 36, 40 in.; Nos. 37 and 38, 20 in. No. 47 was 16 in. high. The percentages of reinforcement are based on the entire cross-section of the concrete.

				Net load					Deflections				
No.	Metal, per cent.	Distance above bottom.	Age in days.	Point "A."	First crack.	Ratio to "A."	Ultimate strength.	Ratio to "A."	Point "A."	First crack.	Ratio to "A."	Ultimate strength.	Ratio to "A."
				1:2:4 Stone, Marked with Open Triangle in Diagrams.									
1	..	.	28	1,200	....	...	2,400	2.00	.001	...	...	.003	3.00
2	..	.	28	1,200	....	...	2,200	1.86	.004	...	...	.014	3.50
3	0.3	1	112	....	2,000	...	3,800	...	...	...	...	...	...
4	0.6	1	116	1,800	4,000	2.22	5,000	2.78	.020	.133	6.66	.185	9.25
5	1.0	1	25	2,500	7,250	2.90	7,500	3.00	.016	.138	8.65	.145	9.05
6	1.0	1	23	2,500	6,500	2.60	7,300	2.92	.025	.150	6.00	.177	7.08
7	1.0	1	80	4,000	7,500	1.87	8,000	2.00	.031	.105	3.39	.122	3.94
8	1.0	1	80	3,500	8,250	2.36	8,500	2.42	.029	.145	5.00	.145	5.00
9	1.2	1	109	1,750	5,500	3.14	11,750	6.70	.016	.093	5.80	.128	8.00
10	1.2	1	124	1,800	5,500	3.05	10,000	5.55	.024	.115	4.79	.240	10.00
11	1.8	1	90	....	6,078	...	12,800	...	...	...	...	...	...
12	1.8	1	109	2,500	8,000	3.19	14,000	5.60	.028	.133	4.75	.275	9.85
13	1.8	1	111	2,750	7,000	2.59	14,500	5.27	.042	.122	2.90	.288	6.67
14	2.0	1	27	3,000	10,000	3.33	12,000	4.00	.022	.174	7.91	.247	11.20
15	2.0	1	25	3,000	10,000	3.33	11,800	3.93	.026	.158	6.07	.208	8.00
16	2.0	1	80	1,800	11,000	6.11	15,000	8.34	.020	.178	8.90	.279	13.94
17	2.0	1	80	2,300	13,000	4.64	15,800	5.64	.026	.162	6.23	.214	8.23
18	3.1	1	108	2,300	13,000	5.65	16,000	6.95	.020	.150	7.50	.181	9.05
				1:2:4 Stone, Marked with Shaded Triangle in Diagrams.									
19	1.0	2	7	....	4,250	...	6,000	...	...	.160	...	.248	...
20	1.0	2	9	2,000	3,500	1.75	5,500	2.75	.026	.101	3.89	.280	10.77
21	1.0	2	25	2,500	5,000	2.00	5,500	2.20	.026	.140	5.39	.163	6.28
22	1.0	2	28	2,000	5,000	2.50	6,250	3.12	.020	.136	6.80	.186	9.30
23	1.2	2	109	2,200	4,500	2.04	8,000	3.67	.028	.087	3.11	.200	7.15
24	1.2	2	106	2,000	4,500	2.25	7,900	3.95	.016	.084	5.25	.206	12.88
25	2.0	2	25	2,000	5,750	2.87	10,250	5.12	.020	.109	5.45	.278	13.90
26	2.0	2	27	2,500	6,500	2.60	10,250	4.11	.030	.133	4.43	.278	9.25
				1:2:4 Stone, Marked with Open Square in Diagrams.									
27	1.0	1	80	2,250	4,000	1.78	6,000	2.65	.024	.035	1.46	.139	5.79
28	1.0	1	80	3,000	7,500	2.50	8,000	2.66	.027	.115	4.25	.133	4.93
29	1.0	1.5	30	2,000	4,000	2.00	6,500	3.25	.020	.087	4.35	.176	8.80
30	1.0	1.5	30	2,000	5,500	2.75	6,400	3.20	.017	.138	8.13	.170	10.00
31	2.0	1	80	4,000	7,000	1.75	13,000	3.25	.048	.098	2.04	.214	4.46
32	2.0	1	80	3,500	6,000	1.73	15,000	4.29	.036	.076	2.11	.270	7.50
				1:2:4 Stone, Marked with Shaded Square in Diagrams.									
33	1.1	1	90	1,600	8,000	5.00	10,900	6.82	.013	.190	7.41	.156	11.56
34	1.1	1	90	1,600	7,000	4.37	14,000	8.76	.014	.077	5.50	.204	14.57
35	1.1	1	90	3,000	9,000	3.00	13,000	3.25	.048	.008	2.04	.214	4.46
36	1.1	1	90	3,750	8,000	2.13	17,150	4.58	.008	.030	3.75	.098	12.25
37	1.1	1	90	4,000	14,000	3.50	18,250	4.57	.005	.019	3.72	.042	8.24
38	1.1	1	90	5,000	14,000	2.80	24,000	4.80	.001	.008	5.00	.013	8.13
				1:5 Gravel, Marked with Open Circle in Diagrams.									
39	0.5	1	90	2,400	4,250	1.77	4,250	1.77	.020	.126	6.30	.126	6.30
40	0.5	1	90	2,000	4,000	2.00	4,300	2.00	.015	.110	7.3	.126	8.40
41	1.0	1	28	3,000	7,500	2.50	8,000	2.66	.025	.160	6.4	.116	7.04
42	1.0	1	28	2,000	7,000	3.00	7,000	3.50	.019	.190	10.0	.190	10.00
43	1.0	1	90	2,500	7,500	3.00	8,000	3.20	.015	.142	9.46	.142	9.46
44	1.0	1	90	2,500	8,500	3.41	8,500	3.41	.014	.166	11.85	.166	11.85
45	2.0	1	28	2,000	11,500	5.75	11,500	5.75	.020	.254	12.70	.254	12.70
46	2.0	1	28	2,000	13,100	6.55	13,100	6.55	.014	.248	17.70	.248	17.70
				1:2:4 Stone 16 Inches High.									
47	0.47	1	365	9,000	11,500	1.26	25,000	2.80	.005	.015	3.0	0.29	60.0

Comparing the strength of 1:2:4 broken stone concrete with 1:5 gravel concrete (Table V), the high value of the latter material is clearly shown.

Table V.—Comparative Strength of 1:2:4 Stone and 1:5 Gravel.

	Average load at			Reference number.
	A	1st crack	Ult.	
Stone.....	2,900	7,188	8,462	3, 4, 5, 6, 7, 8, 14 & 15
Gravel....	2,362	7,981	8,091	39 to 46 inclusive

Comparing the strength of single and double reinforcement (Table VI), it seems that the steel in the compression flange does not add to the strength of the beam and is not economically placed.

Table VI.—Comparative Strength of Single and Double Reinforced Beams.

	Average load at			Reference number.
	A	1st crack	Ult.	
Single.......	4,000	9,940	11,825	7, 8, 16 and 17
Double......	3,187	6,125	11,125	27, 28, 31 and 32

Adjustment of Table IV for Formula.—The internal relations in Table IV enable the results to be reduced to a common basis, in which the relation of the two factors of percentage of steel, computed with reference to the area of the beam above the steel, and the value of the resisting moment may be determined. For this purpose the ratio of the strength of 28 days and the strength of 90 days is determined, and the 28 day beams, Nos. 5, 6, 14, 15, 21, 22, 25, 26, 29 and 30 are multiplied by the factor of 1.317 for ultimate and 0.966 for first crack to render the comparison on the same basis of age, namely 90 days. In the same way beams Nos. 33, 34, 35 and 36 of shorter span are modified to a basis of 80-in. span. The maximum load on beam 18, with 3 per cent. reinforcement, is omitted, because this beam failed by horizontal shear. The remaining beams failed by cracking at the center at a point near the yield point of the metal reinforcement.

In this way diagrams 1 and 2 are prepared, showing the respective values of the resisting moment at the ultimate load and at the first crack respectively as affected by the amount of metal embedded in the beams. The line drawn is drawn to fit the results of the tests on 1:2:4 stone concrete at 90 days. The tests on gravel concrete beams, and on the stone beams of double reinforcement, were not used in obtaining this line, although they are shown on the diagram.

These diagrams are plotted for the net loads. Adding to these the half weight of the beams (about 250 lb.) the value of $M \div bd^2$ must be increased by 25.5 units. The straight line formulas resulting are as follows:

For 1:2:4 stone concrete 90 days old.

Ultimate Loads. $M \div bd^2 = 125 + 348\, p \ldots (1)$

First Crack. $M \div bd^2 = 125 + 195\, p \ldots\ldots (2)$

For 1:2:4 stone concrete 28 days old.

Ultimate Strenth. $M \div bd^2 = 102 + 270\, p \ldots (3)$

First Crack. $M \div bd^2 = 102 + 154\, p \ldots\ldots (4)$

Mr. T. L. Condron in the "Journal" of the Western Society of Engineer for March, 1905, derived a formula similar to No. 3 from part of the above data combined with tests made in other laboratories of 1:3:6 concrete and 1:2:4 concrete of various ages.

The first term on the right hand side of these equations is evidently the amount of resisting moment supplied by the stresses in the steel. Thus, in the third formula, this term is $270pbd^2$. The constant 270 includes the following factors: (1) stress in steel; (2) leverage of the force in the steel about the centroid of the compressive stresses on the cross section. The leverage depends on the location of the neutral axis, and, therefore, on the quality of the concrete (on the proportions and age of the concrete) and on the percentage of the steel. It must be recognized, therefore, that the same constant will not, strictly speaking, apply to different kinds of concrete or percentages. However, the formulas are fairly approximate for preliminary computation.

The most satisfactory method in final computations is that given by Prof. Talbot in a paper appearing in the "Journal" of the Western Society of Engineers, August, 1904. When the quality of the concrete and the percentage of reinforcement are known, the location of the neutral axis is computed, i. e., the distance from the compression face of the beam to the point where the compression stresses become zero.

Assuming the law of variations of these compressive stresses, and, therefore, the location of the centroid of the stress area, the leverage arm from the steel to the centroid is thus known. The resulting moment is then M = area of steel × stress in steel × leverage to centroid of compressive stresses.

The maximum compressive stress in the steel is then computed.

It should be recognized that these computations must take account of the quality of the concrete and that this leverage is different for the various kinds of concrete.

It will be noted that the lines expressing these equations on the diagrams do not run through zero of ordinates. They were drawn to fit the tests of reinforced beams and were allowed to intersect the axis of ordinates independently of the points indicating the tests of plain beams.

The formula indicating that part of the total resisting moment, i. e., the first term, is supplied from another source than the stresses in the steel. Now when in formula (3) p is put equal to 1 per cent., $M \div bd^2 = 102 + 270$.

The first term is nearly 38 per cent. of the second. It may be that these straight lines should be replaced by flat curves running through the origin. The strength of a plain beam would be represented by a horizontal line. The first term in the formula would then disappear.

ROAD GRADES adopted by the department of public works of New South Wales for opening up mountainous districts for settlement have a maximum of 1:14, which "is very seldom exceeded."

The Work of the Philadelphia Water Filters.

So much has been said for and against the work done by the water filters of Philadelphia that the following notes on the subject are of much importance. They are official in a sense, for they are taken from an address before the Engineering Society of Princeton University by Mr. John W. Hill, chief of the Bureau of Filtration of that city. The total yield of all the filters for 1904 was 12,125,350,000 gal., or an average of 44,560,000 gal. daily:

Beginning with the first official week for the Bureau of Health, January, 1904, a careful record was kept of the typhoid fever cases reported from week to week by the district physicians during the year. The record for 1904 embraces a period of fifty-two weeks.

For the purpose of comparison several districts were created, as follows:

1. Wards 21 and 22, with a 1900 census population of 97,000, the district receiving filtered water from the Roxborough filters.
2. The city of Philadelphia, excluding Wards 21 and 22, with a 1900 census population of 1,196,697.
3. Wards 28 and 38, which were regarded by the Health officials as peculiarly exposed to the influence of polluted water from the Wissahickon Creek, which debouches into the Schuylkill River a short distance above the Queen Lane intake with a 1900 census population of 77,035.
4. Wards 23, 25, 33 and 35, which are served with unfiltered Delaware River water from the Lardner's Point Pumping Station, with a 1900 census population of 151,848.
5. West Philadelphia, with a 1900 census population of 148,371.

In comparing Wards 21 and 22 with District 5, some consideration must be given to the exclusive use since June 3, 1904, of filtered water in an isolated portion of West Philadelphia, composed of portions of Wards 24 and 27, and representing about one-third of the total population of that part of the city which lies west of the Schuylkill River. It should be borne in mind that a portion of Ward 21 does not always receive filtered water, Queen Lane unfiltered water sometimes being supplied to the easterly end of the ward.

For several years West Philadelphia has suffered more in proportion to population from typhoid fever than have other parts of the city, and the mitigating influence of the filtered water on the West Philadelphia typhoid fever rates will be pointed out in the comparison.

Considering the several districts for 1904, the typhoid fever rates per 100,000 of census population were as follows:

1.	Wards 21-22	4.12
2.	Philadelphia, exclusive of Wards 21-22	10.19
3.	Wards 28-38	9.09
4.	Wards 23, 25, 33 and 35	11.84
5.	West Philadelphia	18.92

showing reduced case rates, comparing the filtered water, Wards 21 and 22, as follows:

With Philadelphia, exclusive of Wards 21 and 22	59.60%
With Wards 28 and 38	54.70%
With Wards 23, 25, 33 and 35	65.20%
With West Philadelphia	78.20%
Average	64.42%

Comparing Wards 21-22 with the remainder of the city, the reduced case rate in the filtered water wards was 59.60 per cent.

The whole story with reference to West Philadelphia is not told in these figures, and a little calculation is necessary to show what the reduction would have been had not an isolated portion of this section of the city also been supplied with filtered water for the last thirty weeks of the year.

For the first twenty-two weeks of 1904, the total number of typhoid fever cases reported for West Philadelphia was 1,069 of a total for the whole city for the same interval of time of 4,260, or of all cases for the city over 25 per cent. occurred in that portion of the city containing by the 1900 census about 11.55 per cent. of the population, or the typhoid fever rates were in round numbers about twice as great for the first twenty-two weeks of the year in West Philadelphia, as they were in the city taken as a whole.

The isolated filtered water district was established in West Philadelphia about June 3, 1904.

For the last thirty weeks of 1904, the total typhoid fever cases reported for West Philadelphia were 315, while the cases reported for the whole city during the same interval of time were 2,327; thus of all the cases 13.54 per cent. occurred in this section of the city, and the ratio was slightly more than one-half which prevailed for the first twenty-two weeks of the year, the reduction being due to the influence of the filtered water from the Belmont station on the health of less than one-third the population of the district embraced in West Philadelphia.

Considering only the typhoid fever cases which have been reported for the thirty weeks since the filtered water district was established in West Philadelphia, and combining the district for purpose of calculation with Wards 21-22, the total population by the 1900 census thus served with filtered water was 143,805; the total typhoid cases reported were 125, and the weekly case rate per 100,000 of population about 2.90.

The population of Philadelphia, excluding the filtered water districts of Roxborough and of West Philadelphia, by the census of 1900, was 1,149,892, and the typhoid fever cases for the last thirty weeks of 1904 were 2,202, and the weekly ratio per 100,000 of population was 6.383, showing a reduction in the typhoid fever rates for the filtered water district, when compared with the remainder of the city, of nearly 55 per cent.

Considering the first eight weeks of 1905, the estimated population in the filtered water district, West Philadelphia and Roxborough, is 160,560, and the typhoid fever cases eleven, or at the rate of 6.85 per 100,000 of population. The estimated population of the city excluding the filtered water districts is 1,330,687, and the typhoid fever cases reported 678, or at the rate of 51 per 100,000 of population, showing a reduction in the rate for the filtered water districts of 86.57 per cent.

A more satisfactory test is that shown by comparing the filtered water district of West Philadelphia with the remainder of the city west of the Schuylkill River for the thirty weeks ending Dec. 30, 1904.

During this period of time the average weekly typhoid fever cases reported per 100,000 of population in the filtered water district was 1.37, while the rate for the same time for the mixed water district was 9.80 per 100,000 of population, showing a reduction in the typhoid fever rates for the filtered water district of West Philadelphia of 86 per cent.

For the first eight weeks of 1905 the average weekly typhoid cases per 100,000 of population for the West Philadelphia filtered water district was 0.79, and for the mixed water district 11.76 per 100,000 of population, showing a reduction of rates for the filtered water district of 93.30 per cent.

The average weekly rate for the whole city for the same time was 6.65 per 100,000 of population, showing a reduction for the West Philadelphia filtered water district of 88.10 per cent.

In Dr. John S. Billing's discussion of the Vital Statistics of the Twelfth Census, the average annual typhoid fever death rate for Philadelphia for eleven years ending 1900 was 46 per 100,000 of population, and if a reduction of 80 per cent. in the typhoid rates should follow the introduction of filtered water to all districts in that city, the annual death rate from this one disease will be reduced to less than ten, a rate that will compare favorably with the best watered cities of Europe.

An Improvised Hot-Water Shop Heating System.

An interesting adaptation of a waste steam boiler feed-water heating system to the heating of shop buildings and offices was outlined in a paper by A. A. Maver, master mechanic of the Grand Trunk Ry., at Montreal, Que., before the March meeting of the Canadian Railway Club. From the profuse supply of hot water that was secured in an attempt to utilize the waste exhaust steam for feed water heating, the possibility of making use of a portion for heating purposes was conceived and when placed in operation the scheme has proved very successful. A number of buildings of the Grand Trunk system are now being heated this way and it has also been successfully applied to several roundhouses, the most difficult of all railway buildings to heat properly.

The idea originated some three years ago at the locomotive shops of the Grand Trunk Railway at Montreal, in the fact of a shortage of steam supply for power purposes which had resulted from the natural growth of the shops. A condensing system was installed and all the exhaust steam from the various engines, steam hammers and pumps in the shops was piped to the condensers instead of exhausting into the atmosphere as formerly. The water from the condenser was arranged to be stored in a hot well from which it is pumped through a feed water heater into the boilers, the temperature of delivery being very near the boiling point. Inasmuch as the feedwater had formerly been introduced into the boilers at about 65 degrees, this change had so marked an effect upon the operation of the plant that it was found possible to shut down several of the boilers and still maintain the normal steam supply, although originally it was necessary to force all of the boilers. It was estimated that the saving due to the increase in feed water temperature alone was over 13 per cent., although in view of the reduction of labor and maintenance charges it is probably greater.

The system installed for utilizing the waste heat from the exhaust steam is very simple. It consisted of laying return mains from the various engines, pumps, steam hammers, etc., in the shop buildings to a condensing chamber consisting of an old boiler shell with a 10-inch vent to the atmosphere. Inside of the shell there is arranged a funnel-shaped plate with a center opening a short distance above the middle of the tank; jets of cold water are kept playing upon the plate so that all the exhaust steam which enters the shell below the plate must pass through this opening and the flow of water. The steam is ordinarily condensed immediately upon coming into contact with the funnel plate and the water, although when there is an overabundance of steam the atmospheric vent allows it to waste into the air. The hot water of condensation before being pumped into the boilers is purified by being passed through a filter of charcoal which is carried upon a perforated plate some distance above the bottom of the tank; the bed of charcoal is also covered by a fine copper mesh which collects the coarser impurities and can be frequently removed for cleaning. The water is then pumped from the bottom of the tank into the boilers through a closed feed water heater which is heated by the exhaust from one of the larger engines before entering the condenser.

It is interesting to note that aside from the remarkable saving effected by utilizing this waste heat in the exhaust steam, the appearance of the shop buildings has been very much improved, the exhausts used to escape from numerous pipes through the roofs of the various buildings, presenting a very unsightly appearance. Also the troubles caused by icicles forming along the eaves in the winter, especially from the condensation thrown by the steam hammers, has been entirely avoided. These icicles were troublesome in not only obscuring the light from the shops but also from breaking windows when they fell.

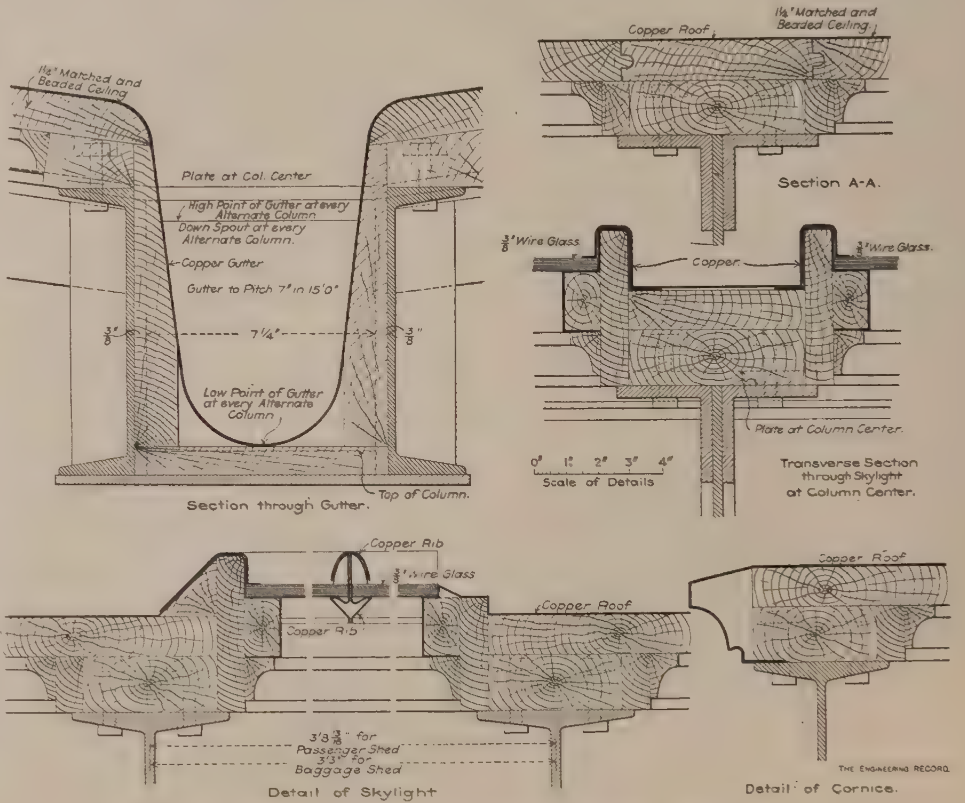
After the system of feed water heating had been in successful operation for several months it occurred to the author that, owing to the abundance of the hot water a portion of it might be used for heating purposes to advantage. An experiment was made along this line by connecting the hot water radiator system in the motive power offices to one of the boiler feed pumps, thus providing, in effect, a forced hot water heating system. These offices had formerly been heated by a hot water heater in the basement which consumed some 70 tons of anthracite coal per winter, besides requiring an attendant for handling the coal, ashes, etc. The building is a 4-story and basement structure, 60x60 ft. in size, and stands in an isolated location about 600 ft. from the shop buildings.

The office system of radiators is supplied through 3-inch flow and return pipes which are carried across in a box about a foot below the ground level. The supply is taken directly from the boiler feed pump through a reducing valve, to keep the pressure down to reasonable limits; in the return line there is connected a retaining valve with its spring set at a pressure of about 15 lbs. greater than the head of water in the building pipes, in order to prevent the water from being siphoned out of the system. The result of this installation was that the temperature in the offices could be maintained at 75° steadily during zero weather where with the former furnace heating there had been frequent complaints about the low temperature in the offices.

The results in heating the offices were so satisfactory that it was decided to similarly heat the railroad Y. M. C. A. building, a 50x150 ft. 3-story building, under erection near the office building. This building was supplied by the same 3-inch mains leading to the office building, although an additional pump was installed in the boiler house for reserve in view of the increased duty. The water is piped in this building by a 5-inch riser to the ceiling of the top floor, where distribution to the various radiator branches is made by a 4-inch main running the length of the building. The branches are 2½ inch connections which drop at frequent intervals on either side to the radiators on each floor, with final connection to the return main in the basement.

This arrangement has given satisfactory service during the past two severe winters. It differs from that in the motive power offices, where the water is forced upward through the radiators, it being thought that the downward flow would perhaps be better adapted for this forcing system, but experience has shown that they are equally satisfactory. By this scheme the railroad Y. M. C. A. was relieved of the expense of installing heating furnaces, and also the much greater expense of providing fuel annually for heating purposes. The new railroad Y. M. C. A. building at Stratford is similarly heated from the works. In the absence of exhaust steam, when the works are closed, the well is heated by live steam.

A large portion of the Montreal works and all of the buildings of the Portland, Me., shops of the Grand Trunk Ry. are now heated by this method, which is being gradually adopted throughout the system for workshops and roundhouses, with certain modifications to meet local conditions. Where the supply of exhaust steam is limited the condenser is dispensed with. Within the past year or two, five new roundhouses have been built at various points on the system which are very satisfactorily heated by passing the exhausts from the stationary engine, air compressor, and pump through the superheater and thence direct into the hot well; the water is then pumped through the superheater, and after circulating through the heating coils returns to the well. In blowing off the locomotives the hot water and steam is discharged direct into the well. The temperature of these roundhouses is such that engines are soon thawed out, permitting of necessary repairs and cleaning being done; and in addition to this, the house being comfortable and warm, the whole roundhouse staff renders more efficient service than when working in discomfort, and the engineers and firemen are attracted to spend their



Details of Roof of Platform Shelters, Washington Station.

spare time working about their engines, as it is the custom with many during the summer, but which only the most faithful and devoted will do in a cold and draughty building.

Mr. Maver also stated that this arrangement has proven so satisfactory that authority has been given to have a similar feed water heating equipment applied to all road pumping stations, and when this has been done, a station or any company's house within a reasonable distance of the pump house may be heated by the boiler feed pump in the manner already described. A pipe of comparatively small dimensions will suffice to carry the hot water to the building to be heated, although the pipe to which the branches are connected should be of such ample proportions as will insure the branch at the farthest extremity being properly fed; in other words, it should be considered as a reservoir to feed the branches.

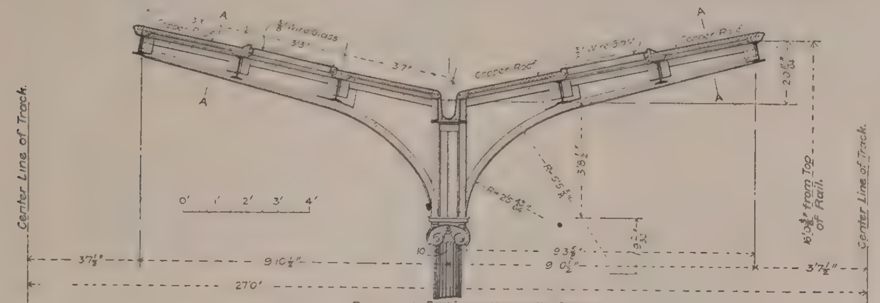
In the discussion Mr. Maver stated that there is absolutely no back pressure brought upon the engines or pumps by this condensing outfit, the operation of the condenser tending toward a vacuum rather than back pressure. Any degree of vacuum is, however, impossible on account of the atmospheric vent provided on the condensing chamber.

The Platform Shelters of the Washington Union Station.

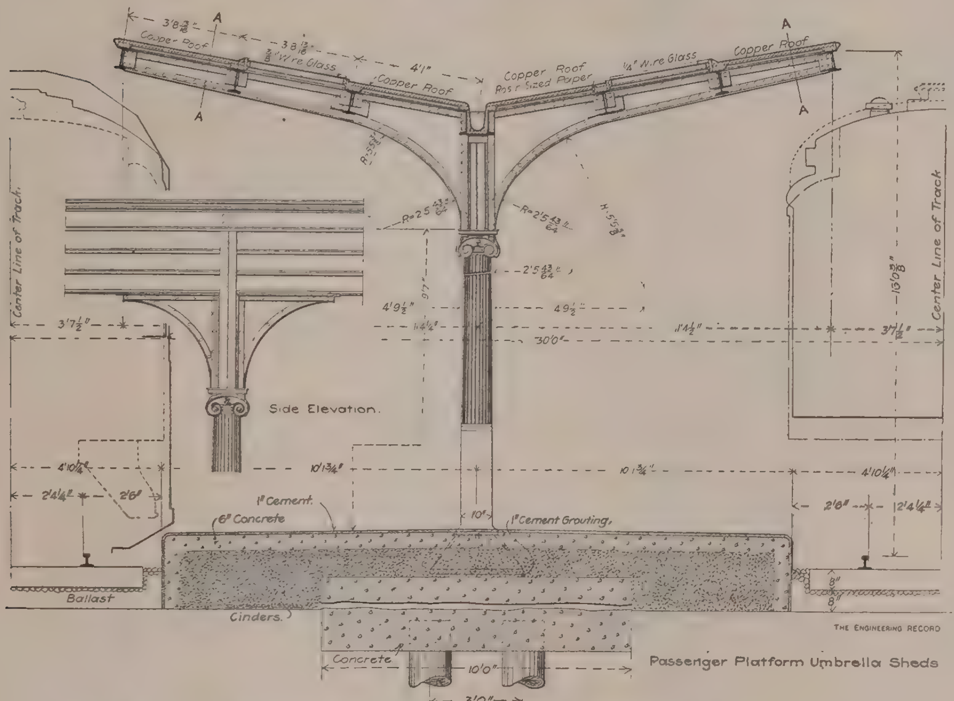
The Union Station now in course of construction in Washington will have no trainshed, but in place of it the shelters shown in the accompanying illustrations will be used. This use of shelter sheds for a station of this character is an interesting instance of the adoption of the type, because the Pennsylvania and the Baltimore & Ohio companies are sparing no expense to make the terminal a credit to the city and themselves. The architectural features have been entrusted to Mr. D. H. Burnham, of Chicago, and have been described so fully in previous issues of this journal that it is unnecessary to refer to them again.

The train platform of the station, of which a plan was given in The Engineering Record of Nov. 5, 1904, is 760 ft. wide. The easterly 280 ft. will be used for handling the Southern business which reaches the station via the tunnel under First St., the plaza and the station. The remaining 480 ft., which will be on a higher level, will handle the business of both railways between Washington and New York, and the west-bound business of the Baltimore & Ohio R. R.

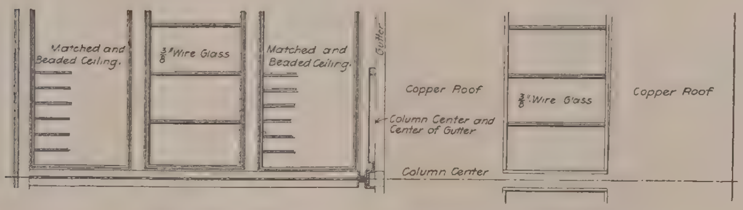
In the design of the shelters for the passageways between the tracks, the new form of roof which has a valley along its center line has been adopted. Experience has shown that this form offers more protection to the people on the platforms than the form which has the eaves at the same elevation, but the roof pitched upward from them. In the latter case more or less water drips from the eaves and is blown by the wind into the faces of the people, while V-roof discharges all the water toward the central gutter. The design of these shelters has attracted much attention, and this journal is indebted to Mr. W. F. Strouse, assistant engineer of the Washington Terminal Co., for the drawings of them.



Baggage Platform Umbrella Sheds



Passenger Platform Umbrella Sheds


Matched and Beaded Ceiling.
3/8" Wire Glass
Matched and Beaded Ceiling.
Gutter
Copper Roof
Column Center and Center of Gutter
Column Center
3/8" Wire Glass
Copper Roof

Part Ceiling Plan. Part Roof Plan.

General Arrangement of Platform Shelters, Washington Station.

Marsh Roads.

A paper by Stillwell H. Townsend in the Report of the New Jersey Commissioner of Highway for 1904.

Three years ago, when the Board of Freeholders of Cape May County asked me to prepare plans for the building of a State aid road across the meadow from Rio Grande to Holly Beach, I was at somewhat of a loss to know just what would be the best materials, taken as a whole, to use. While I have been familiar with salt meadows and building meadow causeways all my life, to prepare plans for a road over these same meadows that, when completed, would be satisfactory to the State Road Commissioner and the Board of Freeholders was quite a different thing. As we had no thought of elevating above storm tides, the prominent idea to be kept in view was the use of materials that would stand the wash.

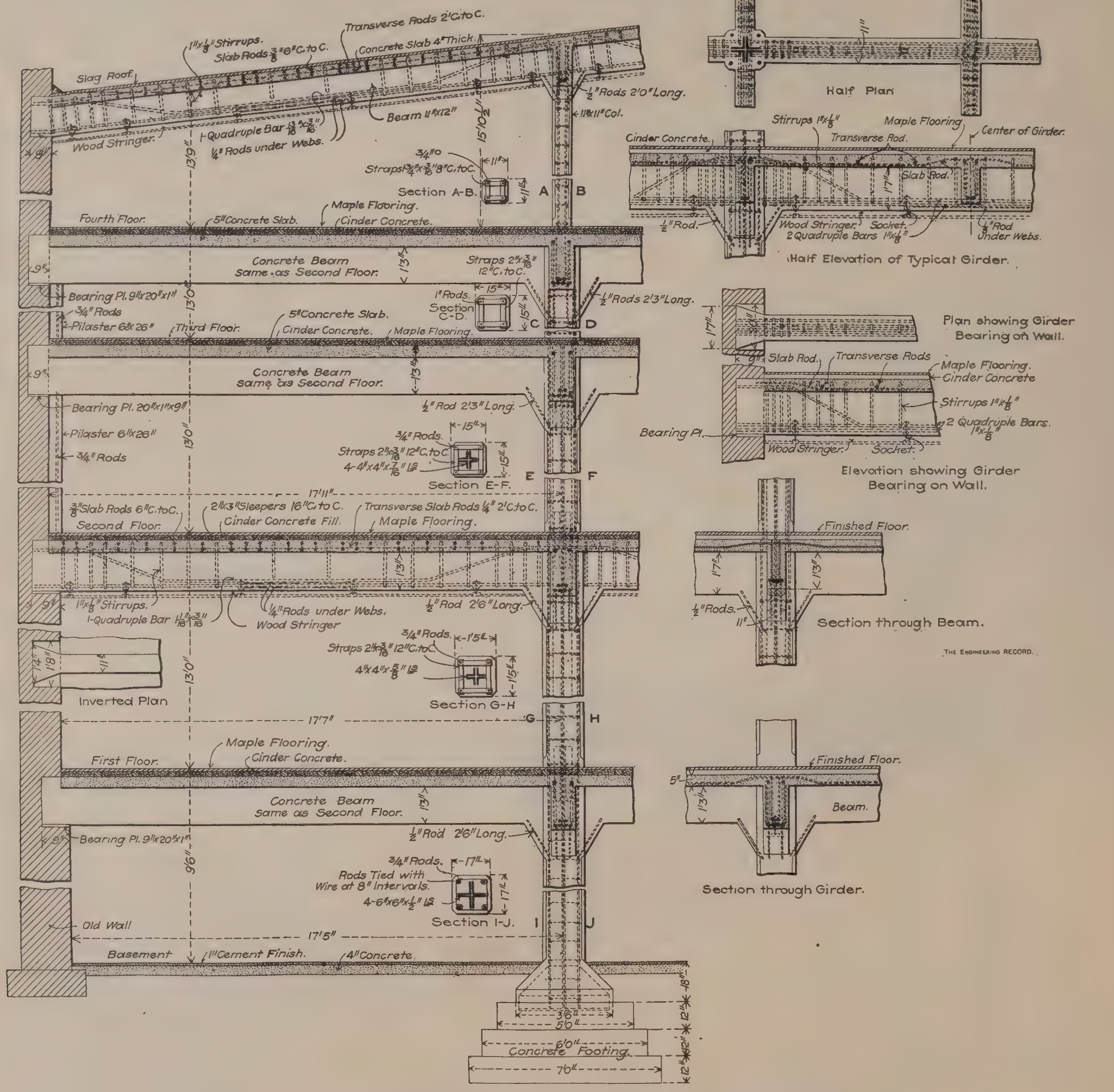
The route to be followed had been abandoned about fifteen years. Previous to that time it had been used, for a few years, as a means of travel to and from the Five-Mile Beach. When this was built about one-half of the distance was laid crosswise with cedar slabs, the other half with small poles, then a very light coat of upland soil, thus making it a corduroy road.

As a means of securing a foundation for the new road large gum trees with two opposite sides flattened were laid lengthwise; one was placed in the center, the other two about under the wheel ruts. Across these were laid poles, about 3 in. in diameter at the small end, the space between the stringers having first been filled with mud. Over the ends of the poles, at each side, were placed 2x6-in. curb planks. These planks were securely fastened, edge up, to cedar piles driven 6 ft. into the meadow and projecting 4 ft. above the planks. These were placed 8 ft. from the center line, thus giving a 16-ft. driveway.

A mud bank was carefully thrown upon each side against the outside of the planks, and thoroughly compacted. The meadow grass grows through this, making it more secure. A line of mud about 2 ft. wide was placed on the inside of the planks and compacted, thus making an almost water-tight trough. The remaining space between the curb planks was filled with upland soil to a level with the outside planks. Over this soil oyster shells were placed, three bushels to the square yard. Over the shells, before they were ground up, was spread a coat of good gravel. This gave an elevation of about 14 in. above the highest meadow passed over, and above tides, except very severe northeast storms. It has been topped several times since it was completed, by storm tides, but it has withstood them beyond all expectations.

One mistake was made in not giving the road more crown before the shells were spread. Shells form one of the best materials that can be used on meadow roads, with just enough gravel spread over them to bind them together. They will thus withstand almost any amount of wash.

Another example of marsh road is the Beesley's Point and Ocean City Turnpike, 1.75 miles across salt meadow. There had been a road on this same route for about twenty years. During that time all but 1,600 ft. of it had been poled three times. Large trees had been cut and laid lengthwise, and poles 9 ft. long laid across them, butting in the middle. In some places this construction had settled 4 ft. into the meadow.



Cross-Sectional Elevation of Review Printing and Publishing Co. Building, Showing Details of Reinforcement.

In reconstructing this road only 1,875 ft. were repoled. This was done by placing six pine tree stringers lengthwise, and poles 9 ft. long crosswise over them, butting in the middle. A double curb plank was placed on each side the entire length of the meadow road in the following manner: Curb planks 2x6 in. were placed 8 ft. each side of the center line, securely fastened to cedar posts driven 4 ft. into the old roadbed; 4 ft. beyond this curb (outside the old road bed) were placed 2x12-in. curb planks securely fastened to cedar piles, driven 8 ft. into the meadow and projecting 4 ft. above the top of the planks. The inner posts and outer piles were securely tied together, the 4 ft. space between the curb plank was filled with mud and thoroughly compacted by ramming, and, after settling, again filled and rammed. Before the road was finished these mud banks were covered with gravel, thus making a bicycle path on each side. The space between the inner curb was filled with upland soil, and after being thoroughly compacted, stood 4 in. in the center above the top of the inner curb planks. These were set to grade. The road was then covered with oyster shells, spread when the bed was not too soft from rain or any other cause. As soon as the shells were spread, a thin coat of gravel was spread over them. This was followed by a 1,500-lb. roller, making the shells and gravel into one compacted mass. After the entire length had been covered in this manner, it was again gone over with a second coat, making in all about 5 in. of loose gravel used on the shells.

One inch above the top of the inner curb plank was placed a 2x6-in. cedar plank, fastened to the top of posts holding the lower curb. When the heavy storm tides sweep over the road some of the crown is in danger of being carried off. These planks were placed there as a protection to the exposed side and to catch what might otherwise go entirely off the road. So far this protecting curb has answered the purpose.

In building meadow roads where it is not intended to elevate above the tides by filling in until all settling has been overcome, the chief aim should be to use materials that will make a solid foundation, stand the wash, and at the same time not overload the meadow and cause it to settle.

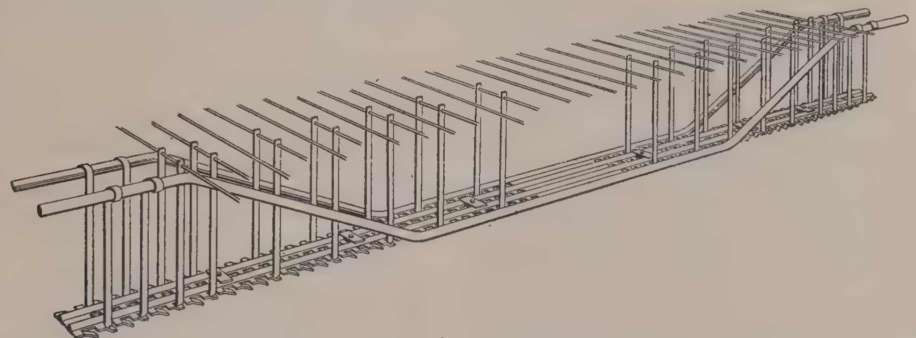
A Magnetic Survey of the North Pacific Ocean will be commenced this season with the assistance of the Carnegie Institute. It is proposed to use a wooden, non-magnetic sailing vessel of about 600 tons, which will sail in a clockwise spiral route embracing the entire North Pacific. About three years will be required to complete the work.

A Reinforced Concrete Building for a Philadelphia Printing Company.

The 38x73-ft. four-story and basement building of the Review Publishing & Printing Co., at Fourth and Locust Streets, Philadelphia, was formerly a brick structure with ordinary floor and roof construction, and was used as an office building. The new owners decided to remove partitions and interior stairs, to provide tower fire-escapes, brick-enclosed elevator shafts and new plumbing, and to make other alterations that would render the building more nearly fireproof. At the suggestion of Messrs. Ballinger & Perrot, architects and engineers, of Philadelphia, they decided also to remove the existing floors and roof and replace them with floors and a roof of reinforced concrete.

The system of reinforcing is somewhat unique and the method by which the steel was placed in the forms is interesting. The different members of the girders and beam reinforcements were assembled before being put into place and when in place the assembled frames were held accurately in position by specially designed fasteners until the concrete had been laid around them.

The basement of the building is 9½ ft. in height. The three lower stories are 13 ft. high, and the top story is 13 ft. 9 in. from the floor to the roof line. The longitudinal floor girders are all 11x19 in. in cross section, and have 15.5-ft. spans. The transverse beams have spans varying from 17 ft. 5 in. to 17 ft. 11 in., and are spaced on 8-ft. centers, with 11x15-in. uniform cross sections. The size and details of the reinforcement in the transverse beams of the four floors are practically the same, one set of 1 1/16-in. quadruple tension bars with 3/16-in. webs being used in each beam, with vertical shear straps spaced in proportion to the tendency of the concrete to shear. Prongs, 2 in. long by ¾ in. wide, on 3-in. centers were punched down from the webs on an angle of about 30°, leaving 1-in. strips of the webs on 3-in. centers, to form a connection between the tension members. The center of action of each tension member was thus insured to be in the same plane as that of the adjacent members.



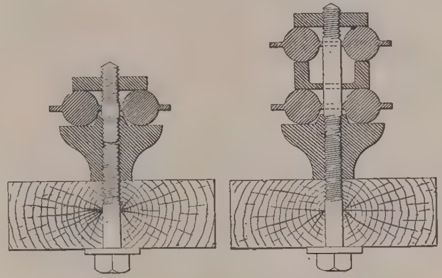
An Assembled Girder Frame, with Slab Rods Laced through Tops of Shear Straps.

The outside bars were entirely sheared from the webs from the end of the girder to a point a few feet from the middle of it and then bent upward to form camber rods, which provide for any negative bending stresses near the girder bearings. The camber rods were made long enough to extend into the adjoining beams, and thus form an interlocking of the frames over the supports. The two central rods of the set are straight and bear on the walls or columns. Threaded through the holes punched in the webs to form the prongs are ⅛x1-in. U-shaped steel stirrups, the prongs under the stirrups being hammered back to clinch the stirrups in position. Part of the stirrups were extended up above the tops of the girders and beams, and the reinforcing rods in the floor slabs were threaded through holes punched in their upper ends after the concrete in the girders and beams was in place. Those toward the ends of the beams were bent around the camber rods to hold them in place.

A working plan of the floors, with each girder and beam numbered on it, was made before construction began, and the frames were built up in a shop entirely separate from the work. Each frame was delivered to the building labeled with the number of the position it was to occupy, and as the centering was erected numbers were placed on it to correspond to those on the working plan. The frames could thus be easily located in their proper place on delivery, and the placing of the steel kept well ahead of the concrete laying.

The frames were firmly fastened to the centering after they had been accurately placed, and were thus held in position while the concrete was being laid. Small holes were bored in the centering from 2 to 4 ft. apart along the center line of the beam and girder forms and hollow cast-steel sockets, 1½ in. high and threaded on the inside, were placed over the holes and fastened to the centering from beneath with threaded bolts. The frames were then set in position, the two central tension bars resting on flanges on the sockets so that threaded bolts could be screwed into the tops of the sockets through holes in the webs between the two center bars. Nuts bearing on these bars were firmly screwed down on the bolts until the frame was securely locked in position. The concrete was then poured in and thoroughly tamped without disturbing any of the reinforcement members. Assembling and placing the steel in this manner also permitted the details of the reinforcement to be checked after the frames had been placed in position and before concrete laying had begun.

The typical longitudinal girders have two sets of 1-in. quadruple bars, with ⅛-in. webs, one set placed above the other. The outside bars in the upper set are sheared from the webs and bent up in the same manner as the outside bars in the transverse beams. Part of the vertical shear straps are fastened to them in practically the same way as they were fastened in the beams. The remainder of the shear straps are threaded through holes punched in the webs between the bars in the lower set. The spacing of the two sets of bars is shown in an accompanying illustration. In order to hold them apart and in their proper position while the concrete was being placed the same style of socket was used that was employed with the frames having single sets of bars, but the bolts screwed into the sockets from the top were long enough to extend through the web of the upper set. The frames were assembled in the usual manner and placed in the form with the two center bars of the lower set resting on the flanges of the sockets. A washer the thickness of the desired space between the sets was inserted between them over each socket and the frame bolted in place as in the beams.



Sockets Holding Girder Frames in Position.

The floor slabs in all four floors are 5 in. thick, and are reinforced with ¼-in. transverse rods on about 2 ft. centers, and by ⅜-in. longitudinal rods on 6-in. centers. The 1¼-in. maple flooring was nailed to 2x3-in. wooden sleepers on 16-in. centers, laid directly on the concrete slab, the spaces between the sleepers being filled with cinder concrete. The roof beams are 11x12 in. in cross section, and the reinforcement in them is spaced practically the same as it is in the floor beams, with 13/16-in. bars having 3/16-in. webs for the main members. The slag roof is laid on a 4-in. concrete roof slab.

The columns in the basement on which the girders and beams of the first floor rest are 17 in. square, placed on broad concrete footings. They have two pairs of 6x6x½-in. angles placed vertically back to back in them. At the corners of a 12-in. square, concentric with these angles, are placed ¾-in. vertcal rods tied together with wire at horizontal intervals of 8 in. The columns in the first story are also 17 in. square, but the angles in them are 4x4x⅝-in. and 2x3/16-in. steel straps are substituted for the wire ties in the basement columns. The second-story columns are 15 in. square, and have 4x4x7/16-in. angles. Those in the third story are also 15-in. square, but they have no angles in them, and the usual ¾-in. vertical rods are replaced by 1-in. rods. The top-story columns are 11 in. square, with 1¾x3/16-in. tie straps on 8-in. centers. The corners of all columns are chamfered, and all beams and girders are knee braced against the columns to provide for wind stresses.

The alterations to the building and the concrete construction were designed by Ballinger & Perrot, architects and engineers, of Philadelphia. The steel in the girder and beam frames was detailed and assembled according to the Unit system by the Unit Concrete Steel Frame Co., of Philadelphia.

Steel Piling has been employed for a unique purpose by the Hodbarrow Mining Co., of England, which is working a rich deposit of hematite close to a tidal foreshore. Shafts have been sunk to the deposits, which are stripped completely, allowing the ground above to settle and thus afford access for the tide to the shafts. Nearly twenty years ago a sea wall was constructed to prevent such an inundation, which it did successfully while some 5,000,000 tons of ore were removed. Then the mines were seriously menaced by an inburst of the sea through a quicksand stratum underlying the wall. Mr. Matthews, of Messrs. Coode, Son & Matthews, was retained to suggest a remedy and provide for further working of the deposit. Under his direction a sea barrier has just been completed nearly 1 1/3 miles long. It consists of a row of steel piling driven 30 to 35 ft. below the surface and topped with clay and puddle. The clay and puddle core is placed between thick parallel mounds of limestone rubble, and the sea face of the outer mound is protected by concrete blocks weighing 27 tons and dumped on the slope without regard to their setting. Their purpose is to break up the waves. The barrier is 83 ft. wide on top and about 210 ft. wide at the base of the deepest section, where the height is 40 ft.

The Coagulation and Precipitation of Impurities in Water Purification.

A paper read before the Cincinnati Section of the American Chemical Society by Mr. Joseph W. Ellms, Chemist, Cincinnati Water Commission.

Certain phenomena frequently observed in connection with the coagulation of suspended matter in water in order to prepare it for filtration, as well as other well-known facts regarding the conditions surrounding the precipitation of soluble impurities in the softening of hard waters, find a rational explanation in the theories advanced by the physical chemist. The research work in this comparatively new branch of physical and chemical science has been chiefly concerned in formulating the laws which govern this class of phenomena. Their application to hundreds of industrial processes, which cannot fail to be benefited thereby, is only a matter of time. The following comments on some of the observed facts in water purification in the light of physical chemistry may be of interest.

Those waters which carry a considerable amount of suspended matter in a finely divided state require the application of a coagulant in order to prepare them for filtration. The use of sulphate of alumina and lately the combined use of sulphate of iron and caustic lime, in order to produce this coagulation, are well known. It has long been recognized that unless the coagulation was carried to a point where the flocculation of the magma and suspended particles was well defined, that poor results would be obtained in the subsequent filtration. It is obvious that the conditions under which the coagulation takes place, the character of the suspended matter, and the soluble compounds existing in the water, are all factors entering into the problem.

The river waters of the Central and Southern States, which contain more or less clay in suspension, and which even on long standing do not completely deposit this finely divided material, may be regarded as a kind of colloidal solution of the clay particles in the water. The size of some of these fine particles is well known to be less than some of our smallest water bacteria, and some of them are too small to be detected by our most powerful microscopes. This pseudo-clay solution acts in some respects like a true solution. It seems really to stand as far as certain of its properties are concerned intermediate between a true solution and a mechanical suspension.

Dr. A. A. Noyes has recently defined non-viscous, non-gelatinizing, but readily coagulable mixtures as "colloidal suspensions"; and regards them as really suspensions of minute particles, and not true solutions. (See "Journal" Am. Chem. Soc., Vol. xxvii, No. 2). He differentiates further by designating mixtures in which the particles may be visible under the microscope as "microscopic suspensions," reserving the term "colloidal suspensions" for those containing particles beyond the limit of microscopic visibility. He considers that there is, however, no fundamental distinction between them.

It seems to the writer that natural waters furnish many examples of colloidal suspensions. Most turbid waters in the natural condition may be considered as mixtures of true mechanical suspensions and colloidal suspensions. A beam of light passed through Ohio River water, even after the sample has stood for many weeks, is plainly visible, in the same manner as when a sunbeam passes through dusty air. This is a fairly good proof of the presence of minute particles in suspension, which reflect the light from their surfaces. Colloidal suspensions of gold and arsenious sulphide artificially prepared act in a similar manner to a ray of light.

Another property of colloidal and microscopic suspensions, apparently depending on the presence of electric charges upon them, is seen in the migration of the colloidal particles by the passage of an electric current through the mixture. Thus the particles of a colloidal suspension of ferric hydroxide or aluminum hydroxide migrate with the positive current toward the cathode, while kaolin and other similar colloidal or microscopic particles migrate with the negative current toward the anode.

An experiment was made with very slightly turbid Ohio River water, from which the coarser material had settled out, in order to see whether any migration of the particles took place, and if so whether they moved toward the cathode or the anode. The experiment was made in a U tube, the ends of which were closed by goldbeaters' skin. The platinum electrodes were placed in distilled water in a compartment constructed immediately above the skin, and the U tube was filled with the turbid river water through a tubulure in the bend of the tube. A current of 216 volts was passed through the water for 6.5 hours. At the end of 4 hours the water had become clear at the cathode, and a perfectly distinct line of demarcation could be seen between the clear water and the turbid water. This boundary line was 6 cm. distant from the end of the U tube over which the skin was tied, 4 hours after the experiment was started. At the expiration of 6.5 hours the boundary line had moved downward 7.5 cm. from the end of the tube. As the distance between the electrodes was about 54 cm. the potential gradient was 4 volts per centimeter, and the average rate of travel of the particles as measured at the end of the experiment was 0.29 of a centimeter per hour for unit potential gradient.

These results are of the same order of magnitude as were obtained by Whitney and Blake for the migration of particles in a colloidal suspension of silicic acid. (See "Journal" Am. Chem. Soc., Oct., 1904.) Silica doubtless formed the larger proportion of the particles in the sample of the Ohio River water with which the experiment was made. The clearing of the water at the cathode and the movement of the particles toward the anode indicated them to be negatively charged. This is in accordance with the numerous and exhaustive experiments made by the above mentioned investigators, and shows the similarity so far as its electrical properties are concerned, between the natural colloidal suspensions in the river water and those artificially prepared.

Turning now to another important property of colloidal suspensions in general, viz., their coagulation, we find that turbid natural waters possess precisely similar properties to colloidal suspensions artificially prepared. Non-electrolytes do not have the power of coagulating colloidal suspensions; but all electrolytes will do so with a proper degree of concentration of the latter, and a sufficient length of time. Acids, bases and salts, therefore, will coagulate colloidal suspensions, all being more or less dissociated in solution and capable of conveying an electric current. In a similar way hydrochloric acid, caustic soda, caustic lime or an ordinary salt solution will all, if of the proper concentration, coagulate the colloidal clay of the Ohio River water. It should always be borne in mind in dealing with natural waters that we are working with extremely dilute solutions of salts, even in those waters which we commonly speak of as high in soluble compounds. In other words the concentration of the electrolytes is very low.

Some quite extensive experiments undertaken on a large scale some years ago, clearly proved that by rendering the Ohio River water caustically alkaline with lime, the suspended clay could be coagulated and could be subsequently removed by rapid filtration through sand. The explanation seems to be that the introduction of the base, calcium hydrate in excess, furnished an electrolyte of sufficient concentration in the water to effect a coagulation of the colloidal clay.

The similarity between artificially prepared colloidal suspensions and the very small suspended particles characteristic of turbid waters as above described, seems to warrant the classification of the latter mixtures with the former. If we seek further analogies in the co-precipitation or absorption by colloids of other substances in solution and suspension with them when these colloids are coagulated, the true character of turbid waters seems even more apparent. When a turbid water containing carbonates of lime and magnesia in solution is treated with sulphate of alumina, for example, a reaction results setting free aluminum hydrate.

The liberated aluminum hydrate absorbs and mechanically traps the finely divided state, but in the course of time it collects into larger particles as a result of the coalition of the smaller particles and of the absorbed and entrapped suspended matter. This process of coagulation of the colloidal clay suspension and co-precipitation of the larger suspended particles, appears to be started by the coagulation of the aluminum hydrate.

The time factor in the coagulation of turbid waters is an important one. It differs with different waters ,and it is by no means clear why these differences in time occur. As illustrations of this difference in time required to effect coagulation there may be cited the fairly rapid coagulation of the suspended matter in the Ohio River water with moderate amounts (1 to 2 grains per gallon) of sulphate of alumina. When very small amounts of suspended matter are present (15 to 20 parts per million), good coagulation will occur in less than half an hour. With larger amounts of suspended matter the period must be increased. As another instance the writer has recently seen a river water of the Central States, containing probably less than 15 parts per million of suspended matter, which did not show any coagulation with one grain of sulphate of alumina per gallon at the end of 4 hours. It was also found that when this water was filtered through a sand filter two hours after the sulphate of alumina had been applied and before coagulation was well defined, that the effluent from the filter was turbid. The colloidal aluminum hydrate, together with the clay, had passed directly through the filter.

In the case of the Ohio River water the soluble salts and organic matter are relatively low, while in the second case they were very high. One would, therefore, expect if coagulation of the aluminum hydrate first formed was due to the electrolytes in the water, viz., the soluble salts present, then the coagulation in the second case should have been better and more rapid than in the first case. It seems possible that where slow coagulation took place the soluble organic matter, which was present in very large amount, exerted a retarding action on the coagulation of the aluminum hydrate. A colloidal form of the aluminum hydrate seems to have been first formed and to have been but slowly converted into a non-colloidal condition.

It is evident, as Dr. Noyes points out in the paper referred to, "that the mechanism of this coagulation is not yet understood," although it appears "that it is the ion with a charge opposite to that of the colloid particles that is mainly responsible for their coagulation." It is also probable that it is the electric charge upon the particle which tends to hold it in suspension.

Another phenomenon common to the coagulation of turbid waters is the adsorption of the applied chemical compound by the flocculent material produced by the reaction and by the associated suspended matter. The particular significance of this fact in water purification was pointed out by Mr. George W. Fuller in his report on the experiments on Ohio River water made at Louisville, Ky., some years ago. While adsorption or concentration of a liquid on the contact-surface of the particles is not alone peculiar to colloids, but is characteristic of all solid precipitates, it has a very practical bearing on the relation of plain sedimentation to coagulation. The loss of chemical by this property may amount to considerable. As yet physical chemists know very little concerning this phenomenon, but the amount of chemical lost is probably proportional to the surface area of the particles of the precipitate, and is a function of the nature of the solid and dissolved bodies, and of the concentration of the latter.

The "schmutzdecke," which forms on the top of slow sand filters, is doubtless a true colloid, and by its absorptive power removes the inorganic and organic suspended matter. The difference between the appearance of the sand of filter beds of slow sand filters receiving water carrying considerable dissolved and suspended organic matter, and those which receive water holding more or less clay in suspension, as pointed out by Mr. Geo. W. Fuller in his recent discussion of Mr. Allen Hazen's paper "On Sedimentation" (Trans. Am. Soc. C. E., Dec., 1904), can perhaps be explained by a difference in the character of the colloids produced or carried by the two types of water. The colloid formed by the soluble and suspended organic matter in a water has probably the characteristic of a true colloid, i. e., a viscous, gelatinizing compound not coagulated by salts (like gelatine); whereas the clay-bearing water produces or carries a colloid which is non-viscous and non-gelatinizing, but which may, however, be readily coagulated. Bacterial activity very likely aids in the formation of the natural scums found on slow sand filters.

In the absence of any artificially applied coagulant like aluminum hydrate the "granular appearance" of sand beds receiving clay-bearing waters indicates the formation of a colloid whose ability to prevent the passage of finely divided suspended matter is limited. The colloidal particles pass deeper into the sand than would a true gelatinous colloid, and their power of absorption is soon exhausted. The "ripening" of the sand beds of both slow sand and rapid sand filters, is, therefore, probably a process of the formation and deposition of colloidal particles upon the sand grains, by which their absorptive power is slowly increased.

It is, therefore, in the character of the colloid formed, that one must seek for the explanation of the phenomena connected with the coagulation and filtration of natural waters. It is evident that much more light is needed on a great many of these problems, but that some of them are associated in some way with the colloidal state of the clay, of the organic matter and of the artificially applied coagulants, is self evident. While the above points may appear to be only of scientific interest, they are in reality intimately associated with the most efficient design of purification plants. The size of coagulation basins, the ability to vary the period of coagulation for any given water, the best chemical compounds to use for the proper coagulation of the suspended matter in the water, the advisability of providing for plain sedimentation before attempting coagulation and the size and character of the sand grains composing the filter bed, are all factors entering into the practical design of water purification plants, which those engineers who are best informed on this class of work always take into consideration.

The softening of hard waters for commercial purposes and for municipal supplies has assumed during the last few years in this country considerable importance. Lime and soda ash are the almost universally used reagents for treating hard waters. The reactions which take place when these compounds are used are those in which the writer wishes more especially to call attention. Lime is used to precipitate the temporary hardness, and soda ash (sodium carbonate) to remove the bases calcium and magnesium which combined with sulphuric or hydrochloric acids, produce the permanent hardness of the water.

In considering the reactions involved from the point of view of physical chemistry, it is evident that we are dealing with reactions which take place in very dilute solutions, and that in the laws governing reactions under these conditions, one must seek for an explanation of the phenomena so frequently observed. Another point to be remembered is that we really have no such a thing as an insoluble substance. The degree of solubility may vary very greatly, but this variation will depend on the nature and condition of the solid substance with which the solvent is contact, with the character of the solvent and with the temperature. In all water softening reactions we endeavor to precipitate the bases calcium and magnesium, the former as a carbonate and the latter as either a carbonate or hydrate. All of these compounds have a relatively low solubility in water. When the conditions of the reaction are known, the completeness of the reaction can be determined for those particular set of conditions, for it must be remembered that no reaction is ever actually completed. In other words all reactions are to a greater or less degree reversible. From a practical point of view, however, we can consider many reactions as complete, and usually so represent them in our equations.

All of the reactions involved in water softening are iron-reactions, that is, reactions of the dissociated ions of the salts in solution with the ions of the dissolved chemical compounds added to the water. These reactions take place in a very short space of time, yet where precipitation of a solid occurs its deposition proceeds much more slowly than we would at first expect. For example, there was added to a hard water containing bicarbonates of calcium and magnesium, a definite volume of lime water. The temperature of the water was 20° Cent. The reduction of carbonates in solution at the end of 6 minutes was 37.5 per cent., at the end of 12 minutes 59.5 per cent., at the end of 17 minutes 68.7 per cent., and at the end of 22 minutes 72.1 per cent. No further reduction in the amount of carbonates had resulted at the end of 28 minutes. The bicarbonates at the end of 6 minutes were reduced 93 per cent., and remained practically unchanged throughout the 28 minutes during which observations were made. It is evident that the carbonates were being slowly deposited from a supersaturated solution.

Ostwald states that in every chemical reaction precipitation follows when the constituent ions of some substance, which is not completely soluble under the circumstances come together in solution. Each precipitation is thus preceded by a state of supersaturation, and after the precipitation has ceased the liquid remains saturated with respect to the precipitated solid. The experiment noted above would, therefore, indicate that we have a supersaturated solution of calcium and magnesium carbonates, which is slowly being transformed into a saturated solution of these salts. The presence of the precipitated solid tends to hasten such a precipitation, as does also agitation of the liquid. It obviously follows that the more soluble the solid is in the liquid the easier is supersaturation effected. Since magnesium carbonate is more soluble than calcium carbonate, the solution will probably contain a larger amount of the former salt in solution, when only enough caustic lime has been added to combine with the free and half-bound carbonic acid. However, if enough lime has been added to convert the magnesium into hydrate, this latter compound on account of its less solubility is likely to be in smaller quantity than the calcium carbonate.

It is a well-known practice in analytical chemistry to use an excess of the reagent in order to more fully and more quickly establish in the solution such conditions that the latter shall dissolve the precipitate to the least possible extent. This depends on well understood laws relating to the equilibrium which must exist between the precipitated solid, the non-ionized portion of itself which is in solution, and the equilibrium of the latter with the dissociated part (the ions) also in solution. In water softening, however, we are obliged to limit the amounts of reagents added to the water, so that no excess shall exist. It is at once evident, therefore, that it is impossible to bring about a complete reaction, and that we must be content with but a partial removal of the soluble impurities present. The limit of removal may thus be definitely determined for any given set of conditions.

It has been found in the intermittent systems of water softening, that a more complete reaction and a quicker precipitation resulted when the sludge from previous precipitations was stirred up with each fresh volume of treated water. The action is probably better, first because of a more thorough mechanical mixing of the reagents and the raw water; secondly, because the resultant agitation tends to produce a deposition of the calcium and magnesium carbonates from their supersaturated solutions as previously explained; and, thirdly, because the larger crystalline grains of the precipitate which have been forming in the sludge, tend to grow at the expense of the smaller crystals and amorphous particles which are just being formed in the freshly treated water. Again, all these changes are hastened by an increase of temperature, a well-known fact which is sometimes taken advantage of in practical water softening plants. The advisability, therefore, of producing as large grained a precipitate as possible in order to increase the percentage of removal by sedimentation and to render the subsequent filtration of the water easier, is at once apparent. The filtration of precipitates which may be crystalline, or, as sometimes happens, colloidal (from magnesium hydrate) is a problem in water softening which needs more study for its successful solution, and it seems to the writer that it can be best approached from the point of view of some of the principles outlined above.

A clear understanding of the laws governing phenomena of this kind will be of the greatest assistance to engineers in designing not only water and sewage purification plants, but in scores of other industrial processes. The writer is well aware that considerations of cost and of insufficient advantages to warrant following too closely theoretical principles, must govern those who design plants involving chemical processes. But failure or success may often depend on seemingly unimportant features of the design accordingly as the principles governing the process are adhered to or not.

Technical Education in Washington finds as much favor as in the East, for more than half of the freshman class in the State College of Washington at Pullman are in the engineering courses. This college, until recently known as the Washington Agricultural College and School of Science, has about 800 students, and has received appropriations of about $275,000 for use in the next two years.

Steelwork in the Twin City Rapid Transit Company's Power House, Minneapolis.

A steam and electric plant, now rated at 10,500-kw., has been installed in a brick and steel building at Minneapolis for the Twin City Rapid Transit Co. At present the building is about 156 ft. wide, 255 ft. long and nearly 100 ft. in extreme height and contains about 2,060 tons of structural steel, but when the ultimate equipment of 35,000-kw. is provided it will be enlarged to a length of 498 ft. The main walls are self-supporting, and, with the columns, have footings on solid rock only a short distance below the surface of the ground. A longitudinal brick wall about 9 ft. from the center line of the building divides the interior into two unequal parts. The engine room, one story high, has a basement about 10 ft. deeper than that of the boiler room, which has one main floor with a 14-ft. basement below it and a system of coal bunkers and coal-conveying apparatus above the boilers, which are arranged in single tiers, one each side of the center line of the room, as shown in the general cross sections and plans of the building published in this journal, Dec. 10, 1904.

The steel framework carries the floors, galleries, boilers, coal bunkers, girder crane, conveying apparatus, steam pipes and roof, but does not support the engines and generators which are seated directly on massive foundation piers with footings on solid rock. It has 125 main columns in seven longitudinal rows and 61 short columns in two intermediate rows to carry the first floors. The wall columns are built solid into the brickwork, but do not carry it. Most of the principal columns are made in two or three sections from about 15 to 36 ft. long, and have I-shaped cross-sections made with an I-beam and two channels, 12 in. or 15 in. deep. The longest and heaviest columns are those in the outer wall of the engine room and are made with one 20-in. I-beam and two 15-in. channels, and have three sections, 22 ft. 4 in., 43 ft. 6 in. and 16 ft. 9 in. long. They are spliced as shown in the detail, with cover plates riveted to both sides of the I-beam web and on the outsides only of the channel webs and flanges, six plates in all. All rivets in the flange splice plates are field driven, in all other plates the rivets in the lower ends are shop driven, and the rivets in the upper end are more numerous and are field driven. The other columns are made with pairs of channels, latticed, some having their flanges turned outwards and some inwards. All the heavily loaded columns are seated on rectangular cast-iron pedestals with longitudinal, transverse and diagonal webs, which distribute the loads sufficiently to diminish the unit pressure to suitable intensity on the footings.

The framework has 14 main transverse bents in the planes of the roof trusses and one secondary bent at the center which divide the building into 14 main panels and two short end panels between the last trusses and the gable walls. The center four panels and the two end panels are from 15½ to 17½ ft. long, all the others are 18 ft. long. The framing in the different tiers of beams is symmetrical about the longitudinal and transverse axes of the engine room and the boiler room.

In the boiler room, except for the special arrangement in the center and end panels, all panels are duplicates except in the first or main tier, where two panels of beams are arranged as one unit symmetrical about the center transverse line to provide for the setting of each group of boilers. Here in the center of the double panel the columns are located in a double transverse row and the beams and girders are arranged as indicated in the part plan. Each double panel is proportioned to carry a load of 800,000 lb. due to the weight of boilers, setting, steam pipes, fittings, water, etc., and the floor in the center aisle between the two rows of boilers is proportioned for a live load of 300 lb. per sq. ft. The center two main panels are a little shorter than the regular panels and the boilers are omitted there to give space for a 225-ft. steel smokestack on each side of the building. The base of the chimney is of masonry, 24½ ft. square and about 80 ft. in height, which extends through the boiler house floors and roof.

In the engine room the main floor is carried between the piers chiefly on 12-in. I-beams supported on the masonry, and in front of the engines on 15-in., 42-lb., longitudinal I-beams, 18 ft. long, supported by pairs of 20-in. transverse I-beam girders riveted to the wall columns. The galleries across the end of the engine room have floors proportioned for live loads of 200 and 250 lb. per square ft. respectively for the first and second, and are made with 12-in. and 15-in. transverse beams framed to single and double longitudinal 24-in. I-beam girders. The main floor in the engine room is made in some places with 1-in. removable cast-iron plates having 3-in. flanges on the under side, supported on the top flange of the I-beams. In other places it is made with a 1-in. cement finish on concrete arches 8 in. thick at the crown, which enclose the smaller I-beam and are seated on skewback angles riveted to the webs of the deep I-beams. A similar arch construction is used for the gallery floors.

The roof over the boiler room has a skylight monitor from end to end on the center line. On each side of its clere-story walls there is over the coal conveyor a narrow sloping roof with a strip of skylight in the center, and a similar roof all skylight on each side wall. Between these and the center skylights there are long, narrow strips of flat roof at a somewhat lower level, over the coal pockets, which are covered with book tiles on longitudinal horizontal T-bars. The principal framing of this roof is of 6-in. longitudinal I-beams supported on light transverse steel frames or bents 13 ft. apart. The engine room roof is made with hollow tile segmental arches of about 4½-ft. span, 6-in. rise and 6-in. thickness, which are sprung from skewback blocks set against the webs of 10-in. I-beam purlins seated on the top chords of the roof trusses in the main bents of the framework. The arches are leveled 4 in. above the purlin tops with cinder concrete, which is covered with a composition waterproof surface.

The riveted roof trusses 69 ft. 4½ in. long and 8 ft. 5 in. deep in the center have horizontal bottom chords and top chords pitched from the center to both ends where they are 6 ft. 3 in. deep. They are divided by vertical posts into five panels, each of which has two diagonal members from the feet of the verticals to the center of the top chord panel. All members have T-shape cross-sections made with two angles riveted together back to back on opposite sides of vertical connection plates. The ends of the lower chords are seated on and riveted to the column caps, except at one end of the building, where one is carried on an I-beam girder between two columns; elsewhere the end vertical member of the truss is field-riveted to the web of the outside channel of the column, which is continued above the column cap and affords a rigid connection with the truss.

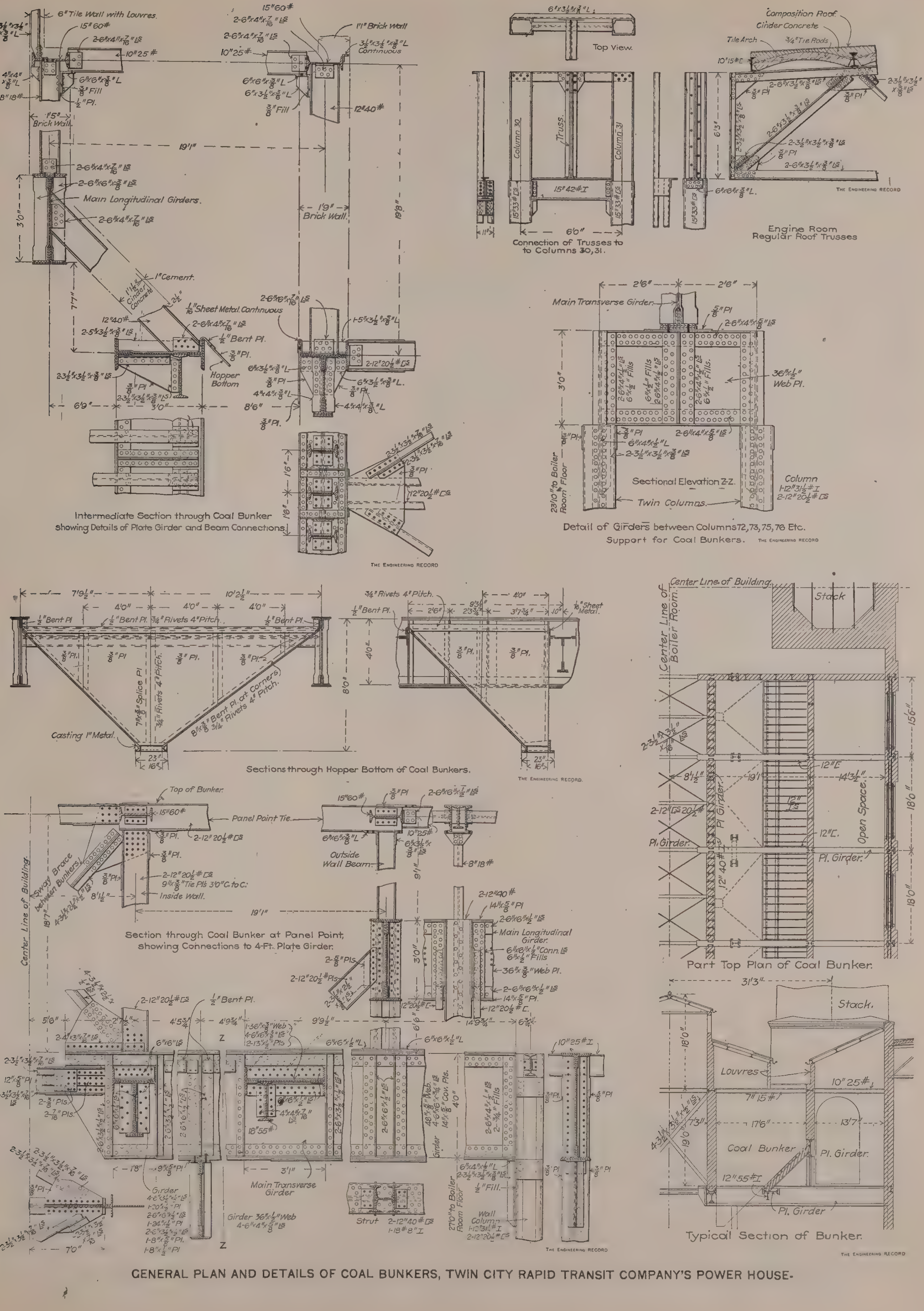
Above the batteries of boilers and supported by the same main columns there are four coal bunkers with a capacity of 700 tons each, symmetrically arranged about the longitudinal and transverse center lines of the boiler room. Each of them is about 102 ft. long, 20 ft. wide on top, and 25 ft. deep over all, and is made in four equal intermediate panels and two shorter end panels corresponding with the panels of the building and the spacing of the columns. The construction is practically the same in all panels and the arrangement of girders, beams and bracing is shown on the general plan of half of one bunker. Each panel of the bunker has a separate eccentric hopper bottom with one vertical side and three inclined sides and an eccentric apex in the middle of the vertical side, as indicated by the dotted lines in the general plan. Above the hopper bottom the transverse vertical section is a trapezoid with horizontal top and bottom and one long vertical side in the plane of the vertical hopper side, on the inner wall of the bunker. The upper side of the opposite longitudinal wall is vertical for 9 ft. below the top of the bunker and the lower part slopes inwards in the plane of the hopper bottom. The end walls are vertical and the vertical parts of the side walls are made of concrete with steel I-beams supported by plate girders arranged to resist all load stresses without interior ties or exterior braces, except those between the opposite bunkers.

The main transverse girders, 4 ft. deep under the bottoms of the bunkers, are all connected to the wall columns at the outer ends and at the inner ends are either cantilevered over the caps of the interior columns or are cantilevered over short longitudinal fulcrum girders which connect the pairs of twin columns at alternate panel points. The wall column connections are each made with 30 field-driven ⅞-in. rivets through the end vertical angles of the girder and with horizontal shelf angle supports reinforced by vertical distributing angles with 24 shop rivets. The cantilever ends of the girders carry web-connected, T-shape longitudinal girders which support the vertical beams in the high side wall of the bunker and have a horizontal web to give it transverse rigidity and provide for lateral pressure.

A similar line of girders, with shorter vertical webs and longer horizontal webs, is web-connected to the transverse girders to carry the feet of the I-beams in the inclined part of the opposite longitudinal wall. The upper ends of these beams are carried by a 3-ft. vertical-web plate girder, supported on vertical columns about 6 ft. clear of the top flanges of the transverse girders. The 3-ft. girder also carries intermediate vertical I-beams about 6 ft. apart and 9 ft. long for the upper part of the outer walls of the bunker. The tops of these I-beams are connected by a 15-in., 60-lb. I-beam, with its web horizontal, to resist the outward pressure which is balanced by pairs of horizontal 12-in. channel ties connecting the opposite walls above the tops of the bunker at panel points. The framing of the taller inner vertical wall of the bunker is similar to that described for the outer wall, except that the vertical I-beams are 12 in. deep and 18 in. apart on centers. Their flanges are connected by 9x⅜-in. horizontal continuous tie plates 3 ft. apart on centers. The hopper bottoms are made with flat ⅜-in. steel plates, not lined with concrete, and have bent splice plates and connection plates field-riveted to the flanges of the horizontal girders.

The ash hopper under each row of boilers is about 88 ft. long and has vertical masonry walls and a horizontal floor of concrete arches between 12-in. longitudinal I-beams, 2½ ft. apart, connected to pairs of 20-in. transverse I-beam girders 18 ft. apart, with top and bottom cover plates, making them virtually box girders. The 12-in. beams are entirely enclosed in the arch concrete, which is filled in to a level 4 in. above the flanges of the box girders and is covered with cement mortar having an asphalted surface pitched about 1:10 to a 25x25-in. scupper casting in the center of each panel. A large body of solid cinder concrete filling on top of the asphalt is surfaced with 6 in. of stone concrete and 1 in. of cement mortar and pitched at a 45-deg. slope to make the inclined bottom sides of a pyramidal hopper in each panel.

The receiving hopper for coal is 35 ft. long and 18 ft. wide on top, with the two opposite short sides inclined about 45 deg. for their full height of 17 ft. and supported in the middle by a 30-in. plate girder. The long sides are formed for the upper 9 ft. by the vertical side walls of the building, and for the lower part by inclined plates like those



Intermediate Section through Coal Bunker showing Details of Plate Girder and Beam Connections.

Connection of Trusses to to Columns 30, 31.

Engine Room Regular Roof Trusses

Detail of Girders between Columns 72, 73, 75, 76 Etc. Support for Coal Bunkers.

Sections through Hopper Bottom of Coal Bunkers.

Part Top Plan of Coal Bunker.

Section through Coal Bunker at Panel Point, showing Connections to 4-Ft. Plate Girder.

Typical Section of Bunker.

THE ENGINEERING RECORD

GENERAL PLAN AND DETAILS OF COAL BUNKERS, TWIN CITY RAPID TRANSIT COMPANY'S POWER HOUSE.

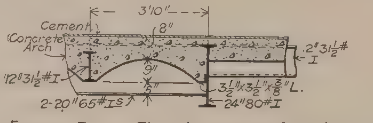
of the other sides, which are supported by and anchored into the wall masonry by Z-shape bent plates built into the brick work. The upper part of the short sides is made with concrete arches on inclined 10-in. I-beams supported at the feet on the girder and at the top built into the wall masonry.

The 40-ton electric crane of 67-ft. span which commands the engine room travels on 24-in. runway girders 44 ft. in the clear above the engine room floor, which are made in 18 ft. lengths and set end to end with about 1-in. clearance on the cap plates of double-web brackets shop-riveted to the wall columns, which have their upper part offset and are continued with reduced width to carry the roof trusses. The runway girders are braced laterally by vertical plates field-riveted to the end web stiffener angles and across the flanges of the column channels which they help to brace together between the upper and lower sections. The center points of the girders are also braced by vertical transverse diaphragm plates field-riveted to their web stiffener angles and having vertical flange angles on the outer edges which receive horizontal bolts clamping them to vertical anchor plates built into the wall masonry.

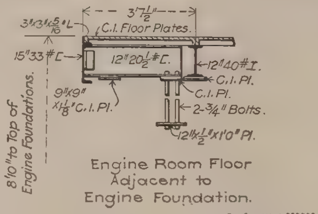
The architects and structural engineers of the building were Messrs. E. C. & R. M. Shankland. The building was designed to conform to the mechanical drawings of Messrs. Sargent and Lundy, who were the mechanical and electrical engineers of the building. The general contractor was Mr. John Wunder, of Minneapolis. The Minneapolis plant of the American Bridge Co. fabricated and erected the steelwork. Mr. Charles F. Ferrin, of Minneapolis, was the superintendent.

Book Notes.

The catalogue of Milliken Bros., New York, is, of course, a trade publication, frankly and openly written to promote the company's business. Nevertheless, it is one of the most valuable books ever prepared for the architect of structures in other countries. This is because it gives all the usual tables of rolling mill handbooks in metric as well as American measures. The book also contains a large amount of valuable information concerning foundations, roofs, sheetmetal and cast-iron work, grilles, designs for bridges and



Engine Room Floor in Front of Engines.



Engine Room Floor Adjacent to Engine Foundation.

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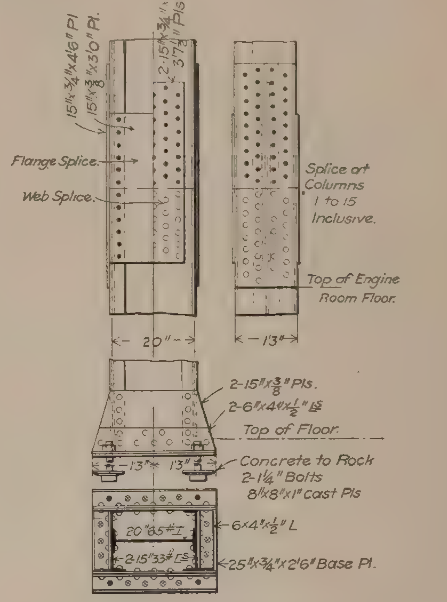

Columns in Outer Wall of Engine Room

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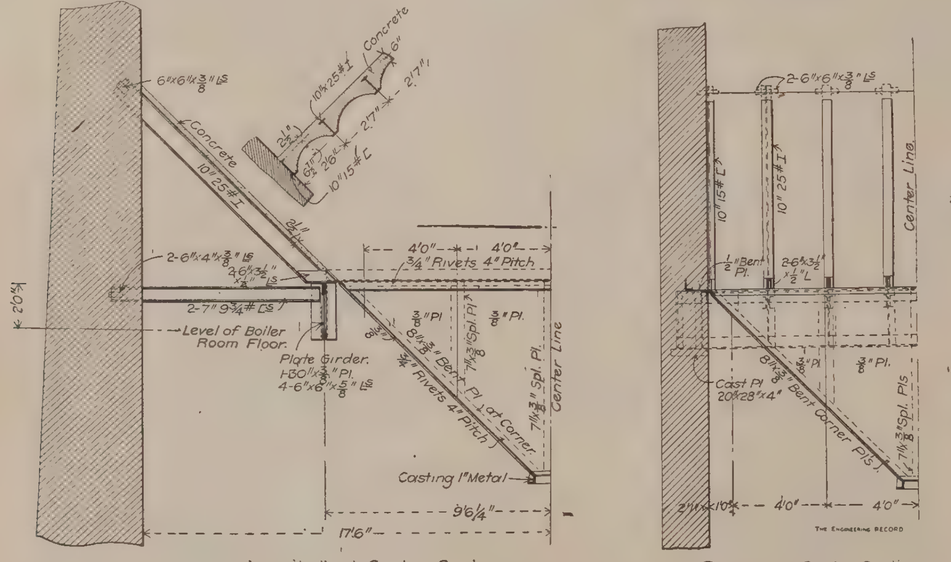

Longitudinal Center Section. Transverse Center Section.

Receiving Hopper.

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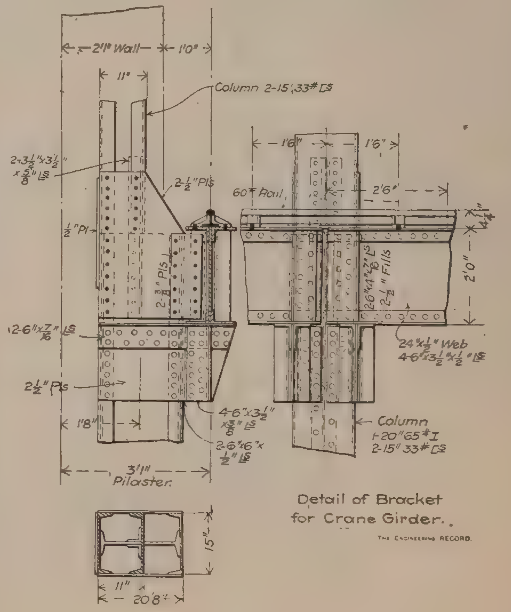

Detail of Bracket for Crane Girder.

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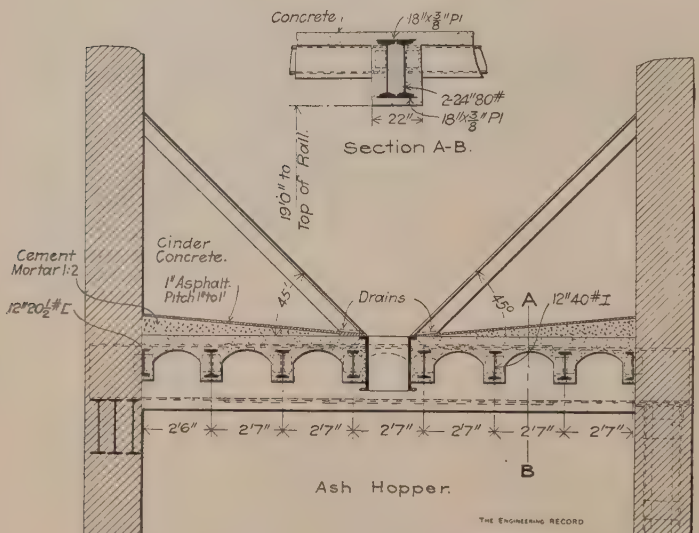
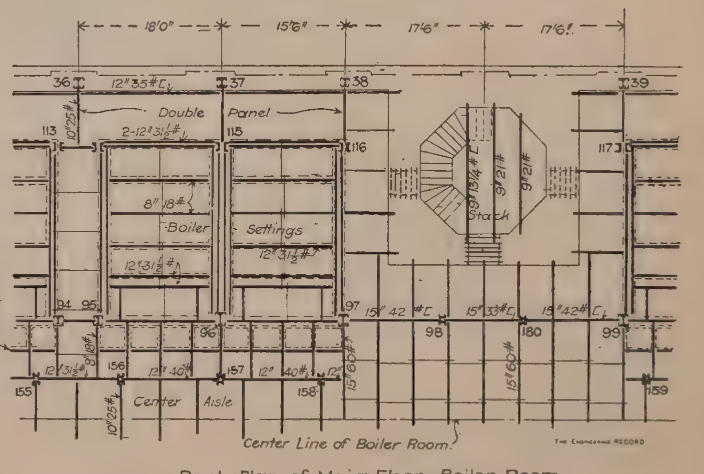


Ash Hopper.

THE ENGINEERING RECORD



Part Plan of Main Floor, Boiler Room

THE ENGINEERING RECORD

RECEIVING AND ASH HOPPERS, AND GENERAL STRUCTURAL DETAILS, TWIN CITY RAPID TRANSIT COMPANY'S POWER HOUSE.

buildings, specifications and the like. There are a great number of illustrations of bridges, and the structural work of buildings which should prove interesting as well as useful, particularly to engineers in other countries. Four editions of the book are published, in English, Spanish, German and French, respectively.

A valuable monograph on the "Baraboo Iron-Bearing District" has been written by Dr. Samuel Weidman, geologist of the Wisconsin Geological and Natural History Survey. It is a very full account of the geology of this interesting and important district, including the ground-water conditions. The chapter on the iron ore deposits and their origin is the leading feature of the book. The report contains many illustrations, and is sold at 10 cents.

A book which will prove timely to a good many readers is a small volume on "Suction Gas," by Mr. Oswald H. Haenssgen. It explains the construction of the suction producer, of several types, points out the purposes of its different parts, and gives hints on the method of running and maintaining it. The properties of suction gas are described, and there are some suggestions concerning gas engines. (Cincinnati, Gas Engine Publishing Co., $1.00.)

The Hoepli manuals are famous among engineers who read Italian as the best examples of book-making, which is good as well as cheap. This is shown in three recent additions to the series. The first is a complete revision of Dr. Sandrinelli's "Resistenza dei Materiali e Stabilita della Costruzioni," the Italian equivalent of Trautwine's hand-book. This book was first started by the late Pietro Gallizia, and the present editor has recast and improved its contents until in some respects the book is a model of condensed valuable data, particularly in the portion relating to retaining walls and arches. The second new book is a revised edition of Mr. A. Marro's "Manuale dell' Ingegnere Elettricista." It is much more complete than English and American books of its character, being much less disjointed and not padded with tables from trade catalogues, which every engineer can obtain for the asking. It is essentially a reference book for the working engineer, covering the various subjects which arise in power plant work in such a way that rules and formulas are furnished but no explanation of the derivation is attempted. In this way an extraordinary amount of information is crowded into the 700 16-mo pages. The third new addition to the series is a very interesting description of inexpensive dwellings; it is entitled "La Abitazione Popolari" and was written by Mr. E. Magrini. It explains various classes of enterprises for constructing such homes in different parts of Europe, and gives a great number of illustrations of them. In these days of industrial village building, American builders will doubtless find a considerable amount of useful information in the many illustrations in the book, even if they are unable to read the Italian text. The volumes are issued by Ulrico Hoepli, Milan, Italy, in well-bound and well-printed form, at the remarkably low price of 5.50, 7.50 and 3.50 lire, respectively.

The Naval Constructor. By George Simpson, New York, D. Van Nostrand Co.; leather, 16mo, 598 pp., $5.00.

This "pocket-book" has been prepared to furnish in concise form information on most of the subjects arising in the work of the marine architect. Accordingly the author gives a great many tables of the properties of rolled steel of various sections, of columns, beams and the like, as well as nearly a hundred pages of mathematical tables. The original matter is mainly on design and in the section relating to standardized fittings. A special feature is the set of freeboard tables and the examples showing their use. Attention is directed wherever necessary to the insurance and legal restrictions governing the design of details.

The book is evidently a compilation of data by an experienced naval architect. There are numerous portions in which the author departs from the customary conciseness of such a book to furnish somewhat detailed advice. This has given the book an individuality lacking in such manuals since the time when Nystrom's handbook was brought out.

Properties of Steel Sections. By John C. Sample. New York, McGraw Publishing Co.; cloth, 8vo, 131 pp., $3.50.

There is a tendency at the present time to require designs for structural work to be prepared in a very short time. The handbooks of the various rolling mills contain information and tables which permit the rapid computation of simple members. There are so many built members required, however, in even a small work that laborious calculations are required when a design is well made. A very large part of these built members fall within less than fifty classes, and the author gives in this book the same kind of tables for each of these classes that are furnished for rolled sections in the handbooks of the mills.

A considerable part of the tables was originally prepared by the author while acting as designer for a structural steel plant. They were so useful that their number was increased so as to cover thoroughly the ordinary members employed by engineers and architects. They give moments of inertia and radii of gyration of built sections, examples of the sections employed in many important buildings, unit stresses, safe loads for columns, plate girder data, timber data and the like. No attempt has been made to give a theoretical discussion of the subjects, only sufficient text being presented to explain the application of the tables. As the book is intended as a working reference book for the draftsman's desk use, this compactness is a feature of decided merit. All values were independently checked after their computation.

Where possible, all controverted points in design have been omitted. There is a diversity of practice as to how much the "back-to-back" of angles should exceed the width of the plate for plate girders and columns, the practice being about equally divided between ¼ and ½ in. The author has used ¼ in. for all sections with less than 42-in. plates, since this is on the safe side for those using ½ in. Where cover plates are not used, it is unnecessary to chip the web plate, and it is seldom necessary to chip where cover plates are used unless it be for very long web plates.

The book fills a space in technical literature hitherto vacant. Its use will save a large amount of time in the drafting room besides shortening the time in which designs can be made. The large orders for the book from structural steel works for use in their drafting rooms is a good indication of its value.

The Modern Asphalt Pavement. By Clifford Richardson. New York, John Wiley & Sons; cloth, 8vo, 588 pp., $3.00.

Mr. Richardson is generally regarded as the leading American authority on the technology of asphalt pavements. The purpose of his book is to explain the nature of asphalt pavements, and to explain how improvements can be made in the methods of constructing them. Few men whose work is largely scientific in character have the author's happy faculty of lucid explanation, and the book is an interesting example of a treatise on a technical subject which is as useful to the taxpayer and the member of a city council as it is to the engineer and chemist. It should be stated, however, that some of the author's statements are not in keeping with the views of engineers who have had considerable experience with asphalt pavements. For example, against his criticisms of the California oil asphalts may be placed the commendatory report on such products by Mr. N. P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City. The author is careful to state his side of a controverted point in such a way as to indicate the existence of another side, and on this account the careful reader need not fear being misled.

The first part of the book relates to the base and the binder. It explains the importance of a good concrete foundation, and gives a very important illustration of the manner in which a crack in the base will cause a similar crack in the wearing surface. The second section describes the purpose and general character of the materials used in the surface mixture. The third section, of eight chapters, is a discussion of the different characteristics of the native bitumens used in the paving industry, the author's preference being for Trinidad lake asphalt. He does not deny that satisfactory pavements can be constructed from other asphalts, especially where the latter are not subjected to trying environment or a heavy traffic, and where considerable skill is exercised in their use. The fourth part of the book explains refining of solid bitumens, the technology of surface mixtures and asphaltic concrete, and the process of combining the constituents into a surface mixture. The information on these very important subjects, with which the municipal engineer is often more or less directly connected, is of great practical value, as is that given in the next part, on the handling of binder and surface mixture on the street. Part six is a short section on the radiation, expansion, contraction and resistance to impact of asphalt surfaces. The seventh part relates to specifications for asphalt pavement, and deals very largely with bitterly controverted data. One chapter, a discussion of the effect of water on asphalt pavements, contains this statement: "The author may state with the utmost conviction that no Trinidad asphalt pavements which have been laid under his direction in the last eight years have suffered from the attack of water when a proper form of construction has been employed." The eighth part relates to the causes of deterioration in asphalt surfaces, and the ninth part explains the chemical control of the work of asphalt paving.

Although a considerable part of the book discusses debatable topics, which will probably be equally in dispute a century hence, the volume is one which nobody interested in paving can afford to be without. A great many engineers who are not in sympathy with all the methods followed in promoting the use of Trinidad asphalt in the past are, nevertheless, of the opinion that the strong attacks on this material now being made are not justified by the record of Trinidad asphalt pavements in service. Mr. Richardson's book will prove particularly interesting to this class.

The Power Gas Works of the South Staffordshire Mond Gas Co. are nearly completed and will shortly be ready to furnish cheap gas equivalent to 15,000 h.p. over a district of 120 square miles. This gas has only one-fourth or one-fifth the calorific value of coal gas, and a large volume must be transmitted to furnish the horse-power mentioned. Tests show that the blowing plant can transmit 1,500,000 cu. ft. of air per hour through 5 miles of mains with a pressure of 10 lb. at the station. This amount of air is equivalent to the total amount of gas to be distributed.

Letters to the Editor.

ECONOMICAL SIZES FOR CAST IRON FORCE MAINS.

SIR: Although the problem of economical sizes for force mains seems to be one which has received but slight attention from writers on hydraulic subjects, very probably due to the fact that it is largely governed by local conditions, it appears nevertheless to be one concerning which a general formula may be derived, that will be of some practical value. It may be stated that a main should be of such a diameter that its cost plus the capitalized cost of pumping against the loss of head incurred with this diameter shall be a minimum. In the following calculation, estimates of the cost of pipe laying are taken from tables prepared by Edmund Weston, while friction factors are from "A Treatise on Hydraulics" by Merriman. A study of Weston's Tables shows that the expense of laying various sizes of cast-iron pipe may be, within the limits shown on the diagrams, quite closely represented by an equation of the form

$y=abfv^2Q\div 2gx$ where

x=diameter of the pipe in feet,

y=cost of pipe and laying per ft.,

n and P=constants depending on the cost of cast-iron pipe.

It is assumed that the size of this pumping plant as a whole is independent of the size of the force main. That is to say that any variation in the diameter of the main necessary to arrive at the most economical result would not require any appreciable change in the capacity of the plant. It is also assumed that the only loss of head is that due to friction. This assumption, through which the velocity head is ignored, not only causes but a slight error, except in the case of very short pipes, but has the decided advantage of eliminating the question of the length of main from the problem. The pumping expense may be represented by the following equation:

$y=abfv^2Q\div 2gx$, where

y=cost of pumping per foot of pipe.

a=capitalized cost in dollars of pumping 1 c.f.p.s. 1 ft. high for 1 year,

b=fraction of a day during which pumping occurs,

f=factor of friction.

x=diameter of the pipe,

Q=quantity pumped in cubic ft. per second.

Substituting for v its value in terms Q and x,

$y=16abfQ^3\div 2g\pi^2x^5$

$y=0.025\times a\times b\times f\times Q^3\div x^5$.

For the total cost we have

$$\frac{x^n+Pq}{p}+\frac{0.025\times a\times b\times f\times Q^3}{x^5}.$$

The condition for a minimum value for this expression is that its first differential coefficient shall equal zero. So we have for the requirement of minimum cost that

$$Q^3=nx^{(n+5)}\div 0.125pabf.$$

This equation must be solved by approximations as the value of f depends upon the velocity which we do not know at the start.

When the price for cast-iron pipe is $25 per ton, which is the assumed value in the accompanying diagrams, the equation for x^n with medium-weight pipe and average digging takes a form very nearly as follows:

$$x^{1.67}=0.99\ (y-0.25).$$

Substituting in the equation for Q we have

$$Q^3=13.4x^{6.67}\div a\times b\times f,$$

which is the equation used in constructing the diagrams.

Yours truly, W. L. BUTCHER.
Cambridge, Mass.

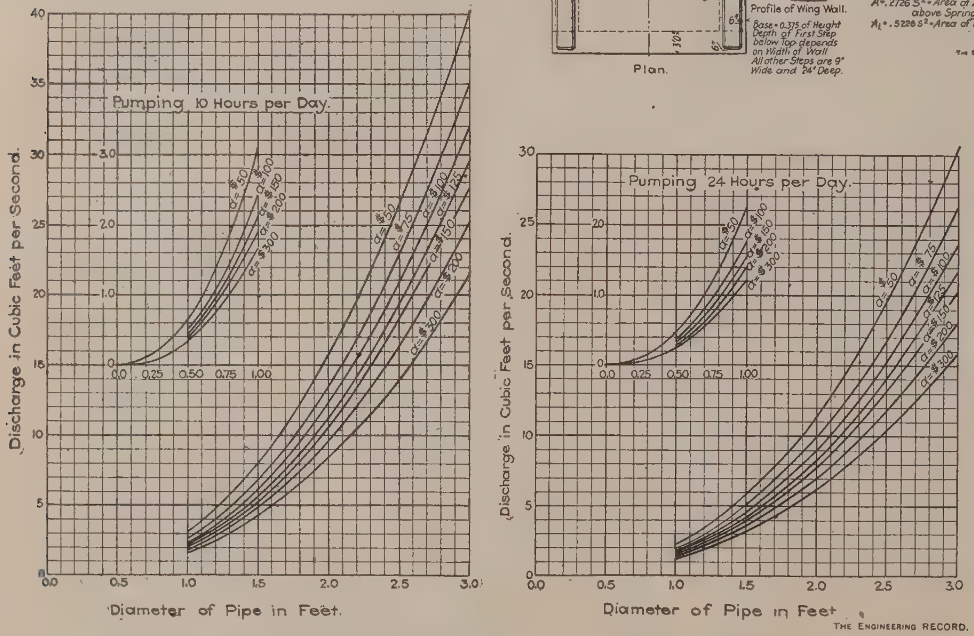
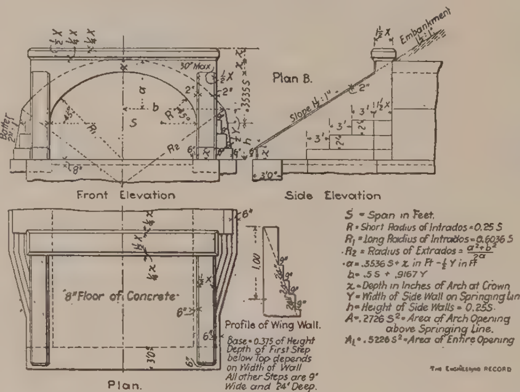
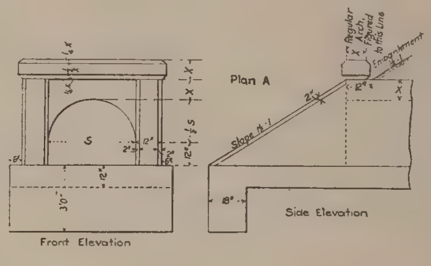


Diagram Showing Economical Size for Cast-Iron Force Mains.

THE DESIGN OF CONCRETE CULVERTS.

SIR:—Referring to the letters of Messrs. Luten and Barlow in your issue of April 15, about the arch of two 20-ft. spans, the writer thinks the points raised by Mr. Luten well taken. In battering the side walls, the waterway is reduced and the cost unnecessarily increased. The side walls of arches properly proportioned need no batter within the arch. They do not fail by overturning inward. Neither is it necessary to batter the front faces of the wing walls. The batter should all be placed in the rear side in the form of vertical faces and horizontal steps. The required bearing area on the foundation should be secured by widening the footing courses, rather than widening the wall also, and thereby unnecessarily increasing the load and cost. The writer is also in favor of straight as against flared wing walls in all cases where the water approaches the arch parallel to the side walls. This is the simplest form of construction, gives a minimum amount of material, and any drift that will enter between the wings will go through the arch. Generally, a single arch of capacity equal to the two 20-ft. spans would cost no more and give a better waterway, especially if the stream carries much drift.


Plan B.
Front Elevation
Side Elevation
Plan.
Embankment
Slope 1½:1"
30" Max.
Batter
8" Floor of Concrete
Profile of Wing Wall.
Base = 0.375 of Height
Depth of First Step below Top depends on Width of Wall
All other Steps are 9" Wide and 24" Deep.
S = Span in Feet.
R = Short Radius of Intrados = 0.25 S
R1 = Long Radius of Intrados = 0.6036 S
R2 = Radius of Extrados = (a²+b²)/2a
a = .3536 S + x in Ft − ½ Y in Ft
b = .5 S + .9167 Y
x = Depth in Inches of Arch at Crown
Y = Width of Side Wall on Springing Line
h = Height of Side Walls = 0.25S.
A = .2726 S² = Area of Arch Opening above Springing Line.
A1 = .5226 S² = Area of Entire Opening
THE ENGINEERING RECORD



Type of Concrete Arch used on the St. Louis Kansas City & Colorado R. R.

The writer encloses a blue print of concrete arches of which about 400 ranging in span from 2 to 36 ft. have been built and are in service under railway embankments of earth and rock ranging in height from 3 to 60 ft. above the top of the arch. None of them has failed. A few of them have cracked, due to unequal settlement of earth foundations; but on rock foundations, no cracks have appeared except some very thin seasoning checks, which frequently appeared before any load whatever was placed on the arch. You will observe that the height of the side wall is limited to one-quarter of the span.

Yours truly, J. L. CAMPBELL.
El Paso, April 26.

Long Distance Telephones in Railroad Operation

An extensive railroad long-distance telephone system is now in service upon the New York Central lines, including the West Shore, Lake Shore & Michigan Southern and the Pittsburgh & Lake Erie. The system is over 950 miles long, with a branch to Pittsburgh, and is carried upon the telegraph pole lines, being constructed of copper-wire, metallic-circuit line throughout, with half-mile transpositions. There are numerous local private branch exchanges which are especially arranged for the convenience of the local business. The system has proven an important measure of economy. The entire plant is owned by the railroad company and operated under contracts with the American Telephone & Telegraph Co., and the local telephone companies in the various cities.

OSMIUM INCANDESCENT ELECTRIC LAMPS are now made commercially by the Deutsche-Gasglühlicht A.-G. A 37-volt lamp has an osmium filament 28 cm. long, 0.087 mm. in diameter, and gives 25 c.p. at 1.5 watts per candle. Lamps of 110 volts have recently been made, while a 2-volt safety lamp is used successfully in mines.

CURRENT NEWS SUPPLEMENT

MAY 13, 1905.

DIRECTORY OF NATIONAL TECHNICAL SOCIETIES.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Annual convention, Cleveland, June 20-23. Next meeting, May 17, paper on irrigation at Ontario, Cal.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Annual convention, Asheville, N. C., June 19-23. Next meeting, May 16, papers on relays, circuit-breakers and oil-switches, and the proper limit of duplication to secure reliability of service.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, Frederick Brooks, 31 Milk Street, Boston, Mass.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York. Annual meeting, Chicago, July 7 and 8.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St. Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa. Annual meeting, Atlantic City, June 29-July 1.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

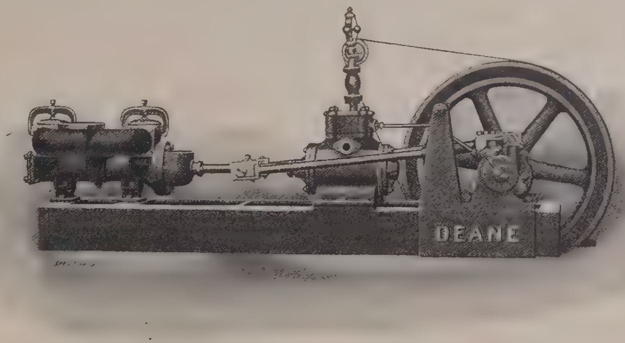
THE DEANE FLY-WHEEL MAGMA PUMP.

The growth of the sugar industry in the United States has created a demand for several types of pumping machinery specially designed for this service. To meet this demand the Deane Steam Pump Co., of Holyoke, has recently introduced a machine for moving thick, heavy fluids and semi-fluids, the handling of which usually offers so much difficulty in sugar-house work. A consideration of primary importance in the design of a pump for this use is absolute dependability, and the pump must be of such a character that it will operate with certainty at all times.

Magma pumps are largely used in sugar houses to move the thick semi-fluids which require to be handled in connection with such work. For such service it is important that the pump be made with extra large passageways for the liquid, and with the smallest possible number of working parts in the pump cylinder. To meet these requirements the Magma pump is constructed with a large suction opening, usually larger than the pump cylinder bore, opening downward directly into the center of the pump cylinder. There are no suction valves in the pump. The pump piston travels across the large suction inlet, and after this opening is closed, all the material remaining between the pump piston and the cylinder head is expelled through a special form of discharge valve arranged to give a particularly large and free opening. With this type of pump it is essential that the liquid handled should flow to the pump under a head. The same features that render this pump so particularly desirable for sugar-house work, make it equally suitable for handling any other semi-fluid material. It will successfully pump soap, whitelead, printer's ink, and similar heavy liquids.

In addition to these qualifications, the present machine has a number of features which render it particularly valuable for this work. The passages of the water end are large and direct. The discharge valves are large and easily accessible for inspection through liberal-size handholes. When furnished as a tail pump for removing from vacuum pans, the stuffing box is submerged, thus insuring absolute air-tightness. There are no small internal parts likely to become clogged or broken.

The steam end, as stated, is of the fly-wheel type. The steam consumption is decreased and the efficiency of the entire machine increased by the small clearance which it is possible to use in connection with the positive stroke due to the crank and fly-wheel. The speed, under changing conditions of load is closely regulated by an approved throttling governor.



PUMP FOR THICK LIQUIDS.

THE INTERNATIONAL RAILWAY CONGRESS.

The opening of the International Railway Congress, at Washington, D. C., Wednesday, May 3, marks the seventh gathering of railroad men from this country and Europe for the interchange of ideas and discussion of railway subjects. The importance of this work is indicated by the granting of a large appropriation by the Government, and the active part taken by Vice-President Fairbanks emphasizes the character of the proceedings. The previous sessions of the Congress abroad have borne the same semi-official aspect and engaged the attention of government as well as railway officials.

The Congress began May 3, by the registration of delegates at the New Willard Hotel, in Washington. No official sessions were held on May 3, but the American Railway Appliance exhibition on the monument grounds was opened at noon. The opening address was made by Mr. Geo. A. Post, president of the committee of arrangements. Mr. Post then introduced Hon. H. B. F. Macfarland, president of the board of District Commissioners, who welcomed the delegates to Washington. Mr. George Westinghouse, to whom had been assigned the honor of president of the exposition exhibition, then delivered an address, after which he introduced Secretaries Morton and Taft ,of the Navy and the War Departments, respectively, Hon. C. M. Lawrence, vice-president of the London & Northwestern Ry., and Mr. Stuyvesant Fish, president of the American Railway Association, each of whom made an address. In the evening a dinner was tendered to the executive committee of the International Railway Congress and other distinguished guests at the Hotel Raleigh, by the American Railway Guild, at which President Theodore N. Ely, of the Pennsylvania Railroad, presided. An interesting feature of the opening day was a time signal which was transmitted around the world, at 11.30 P. M., from the exhibition grounds through the Naval Observatory; the speed of the message was indicated on a large diagram, at which the different telegraphic stations through which the message passed were indicated by incandescent lamps, and as the message was received the lamps were illuminated.

The opening session of the Railway Congress was held at the Hotel Willard, Thursday morning, May 4, at 11 o'clock. At the request of the Government, Vice-President Charles W. Fairbanks welcomed the delegates. Mr. Fairbanks' address of welcome was followed by an address in French by Mr. Ernest Gerard, after which Mr. Fish, as president of the American Railway Association, delivered a speech in which he gave statistics of the railways in this continent, closing with the announcement of the provisional presidents of the four sections, as follows: Stuyvesant Fish, of Section 1, Ways and Works; Theodore N. Ely, of Section 2, Locomotives and Rolling Stock; Sir George Armytage, of Section 3, Working; M. Perouse, of Section 4, General; Ernest Gerard, of Section 5, Light Railways. The meeting then adjourned.

A trip was made to Mt. Vernon by special steamboat Thursday afternoon, at the invitation of the American Railway Association. In the evening a reception was tendered the delegates by the trustees of the Corcoran Art Gallery, assisted by the Commissioners of the District of Columbia.

On May 5, the sections commenced a consideration of technical subjects. Sections 1, 2 and 5 met and reports were read. In Section 2, J. E. Muhlfield, general superintendent of the Baltimore & Ohio R. R., read an abstract of his report on the increase in power of locomotives by adoption of higher pressures and of the compounding principle. He pointed out the possibilities of future locomotive design and the restrictions that are imposed by existing conditions. He called attention to some of the pressing needs as to more simple and effective designs, standardization, etc. In Section 5 a paper prepared by C. de Burlet of the Belgium National Light Railways was read, in which the effect of the light railways upon main lines was considered. The discussion was almost entirely upon conditions in Europe, where light railways have been brought to a higher development than in this country, and the resolutions adopted as a result of the deliberation were in their favor. They were as follows:

"It may be said in general that light railways, when they are really tributary to main lines, are unquestionably useful auxiliaries to the latter, consequently the friendly cooperation of the main lines and concessions by the latter of desirable facilities are fully justified; and it is to be desired that all railway management should be inspired by the same liberal ideas held on the subject in Austro-Hungary and adopt as broad and simple conditions as possible to facilitate junctions and the operation of interchange of traffic with light railways."

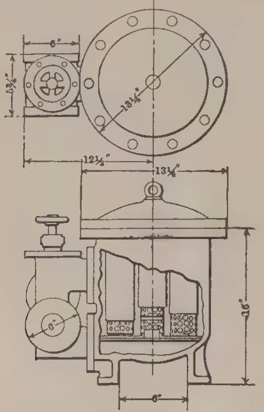
A meeting was also held in Section 1 in which the question of "Wooden Sleepers or Crossties; Selection of Kinds of Woods and Processes of Preservation," was considered. An interesting and important discussion followed the reading of Mr. Hausser's report on the subject, the discussion being continued over to the second meeting of this section on May 6, when Mr. Kendrick's report received careful discussion. Section 3 held its first meeting on May 6, discussing the subject of "Baggage and Express Parcels; Methods of Handling, and of Avoiding Detentions, Losses, etc." A second meeting of Section 2 was also held at which the discussion started the day before upon the subject of "Locomotives of High Power" was continued. Permanent officers of the five sections were elected on May 6, after which the Congress adjourned until Monday, May 8.

ANNUAL MEETING OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

The American Society of Municipal Improvements will hold its annual meeting at Montreal, Canada, Sept. 5, 6 and 7, in connection with which the associate members will exhibit materials and apparatus, used in the construction of municipal works, which exhibition, it is thought, will be the first of its kind to be held on this continent. Only those who are or shall have become associate members will contribute to this exhibition, and no charges of any kind will be made for floor space, the cost being met by the regular dues; except, that where more than a unit space of 5 ft. front by 10 ft. deep is desired, additional spaces of this size may be had at a charge of not to exceed $15 per unit space. Attention is called to this statement by the officials of the society, because assertions to the contrary have been made in certain quarters. Further particulars may be had by addressing the secretary, Mr. George W. Tillson, municipal building, Brooklyn, N. Y., or the president, Mr. A. Prescott Folwell, Easton, Pa.

A FILTER AND GREASE EXTRACTOR FOR BOILER FEED WATER.

The Blackburn-Smith feed-water filter, illustrated herewith, is designed for use in boiler feed lines where impure water must be used. Its purpose is to free the water from oil, mud, sand or any other species of mechanical impurities, and without offering undue resistance to the flow of the water. The filters are designed and rated with special reference to the amounts of water to be handled per hour and the rate of flow through the filtering media is kept low to produce the best results.



THE BLACKBURN-SMITH FEED-WATER FILTER.

The filtering is done by passing the water through the sides and into cylindrical screens or cartridges covered with "stockings" of a special toweling or cloth, the cartridges consisting of large bronze tubes with numerous perforations. The latter are removable for cleaning, and an extra set forms a part of each filter's equipment, which may be kept covered with clean filtering cloth in readiness for a quick change. In changing cartridges, the flow through the filter is temporarily bypassed by the special valve at the inlet and outlet connection side, which cuts out the filter chamber; then by removing the cover the cartridges may be removed and replaced by clean ones. This filter is built in seven sizes, with capacities of 12,000 to 162,000 lb. of water per hour by the Greacen-Derby Engineering Co., Perth Amboy, N. J.

TRADE PUBLICATIONS.

The award of a grand prize and gold medal to the Laidlaw-Dunn-Gordon air compressor, at the Louisiana Purchase Exposition, was probably due in a considerable degree to the new Cincinnati valve-gear with which these compressors are equipped. This important invention is clearly described in a well-illustrated pamphlet, "Bulletin L 508 R," which can be obtained on application to the Laidlaw-Dunn-Gordon Co., 114 Liberty St., New York.

The S. K. C. polyphase induction motors are described in much detail in Bulletin 141 of the Stanley Electric Mfg. Co., Pittsfield, Mass. The three general types of induction motors are explained, the character of service each is best fitted for is stated and diagrams and tables of dimensions of the different sizes are given. There is also furnished a description of the S. K. C. starting compensator, with diagrams of its connections on two-phase and three-phase circuits.

An electric igniter for gas engines is described in a folder from the Goodson Electric Ignition Co., Providence, R. I. It requires no batteries and consists of a plug and an igniter. The plug is screwed into the cylinder head or ignition chamber of the engine, and furnishes a spark when its two electrodes are separated when current is received from the igniter. The latter is a magnetic machine driven by the engine, and so designed that its armature is revolved through a considerable arc at a sufficient speed of the engine.

The governing of water-wheels is described at length in a well-illustrated pamphlet from the Holyoke Machine Co., Worcester, Mass. It explains the construction of the apparatus in detail, and points out the special advantages claimed for it. Although a new device, about thirty are already in service, and letters from some of the users are published to substantiate the claims made for it. In writing for the pamphlet it should be referred to as "catalogue A," as the same company issues another catalogue devoted to water wheels exclusively, of the well-known "Hercules" type.

The problem of covering walls, ceilings and wainscotings with an easily cleaned material has led the New York Metal Ceiling Co., 537 West 24th St., New York, to bring out Enametile, a highly enameled, non-corrodible, embossed, flexible metal covering. It is finished to represent ceramic tiling, and is applied with a specially prepared cement directly to the finished plastered walls. It weighs about 6 oz. per square foot, can be trimmed with shears, and the enamel does not break when the plates are curved or bent. A series of leaflets showing in color some of the many designs of this material is now being published by the company.

Recent additions to the publications of the General Electric Co., Schenectady, N. Y., include Flyer 2,139 on shunt-wound generators of ¼ to 1¾-kw. capacity; Flyer 2,140 on D. C. ceiling fan motors; Flyer 2,138 on enclosed fuse cut-outs; a Folder concerning ready-made electric lighting outfits for decorative purposes; Bulletin 4,381 on A. C. switchboards for small plants using 1,150 and 2,300 volts; Bulletin 4,382 on Thomson inclined coil portable indicating instruments.

The new centrifugal pump catalogue of the Morris Machine Works, Baldwinsville, N. Y., is a book of data of value to all users of such equipment. The company makes single and multistage pumps, ranging in size from the little 1½-in. size up to the enormous 48-in. dredging equipment completed not long ago. The book describes the construction of the various types, explains their uses, gives suggestions for setting up and running them, and also furnishes useful information concerning the various types of engines which are made for driving pumps and for other purposes.

Washing blue-prints is a tedious and sloppy operation as ordinarily conducted. It can be made simple and expeditious, however, by using a compact washing and drying machine described by C. F. Pease, 179 West Locust St., Columbus, O. He explains its construction and operation in a well-illustrated pamphlet.

The April number of "Air Power," the quarterly publication of the Rand Drill Co., New York, contains a complete description of the gas pumping plant at Hundred, W. Va., a very complete graphical analysis of Boyle's law, and a valuable discussion of the opportunities for introducing economy in the power plants of collieries. There are also a number of short articles containing useful data.

The Boston Crude Oil Burner Co., Board of Trade Bldg., Boston, has issued a little folder describing the Jackson oil rivet forge for bridge and ship work. A forge with a capacity of 3,000 rivets daily requires but eight gallons of oil in that time and weighs but 100 pounds.

Warren Webster & Co., Camden, N. J., have issued a small pamphlet on the use of exhaust steam, which briefly takes up the Webster system of steam circulation for heating purposes.

The Snider-Hughes Co., Cleveland, O., has issued a booklet on the Monitor duplex steam pump, which contains an illustrated description of the pump and the advantages of its design and operation, together with several tables of value to those interested in steam pump operation.

Pamphlet No. 052, issued by the C. W. Hunt Co., West New Brighton, N. Y., deals chiefly with coal handling apparatus for various conditions, although the industrial railways, hoisting engines and supplies manufactured by the company are also taken up. Pamphlet No. 051, issued by the same company, is given over to industrial railways and equipment and has a number of views of installations.

Catalogue 59 of the New York Blower Co., 25th Place and Stewart Ave., Chicago, illustrates two types of forges which have a new device for moving the down-draft hood. These forges have been designed particularly for railroad shops, manual training schools and the like.

Crane & Co., Chicago, have issued a circular relating particularly to steam and oil separators, made in sizes from 1 to 30 in., and in horizontal, vertical, angle and distributing types.

A book on industrial railway cars and track has been issued by the Wonham-Magor Engineering Works, New York, which contains useful data regarding such equipment. Illustrated descriptions are also given of various kinds of light cars for special purposes, trucks and light locomotives, making the book of special value to managers of industrial plants, contractors and others who are interested in light railway problems.

The Marsh Bridge Co., Des Moines, Iowa, has issued a pamphlet containing views of a number of reinforced concrete bridges which the company has recently built to meet various conditions in the Middle West. Several construction views are shown and a fair idea of some of the bridges which have been built of reinforced concrete in the upper Mississippi Valley may be drawn from the pamphlet.

The 1905 catalogue of the Fischer Foundry & Machine Co., Pittsburg, Pa., contains nearly 200 pages of illustrations which have been specially prepared to show the construction of the heavy machinery equipment for rolling mills, steel works, tube mills, boiler shops and bridge works which are made by this company. The company's works are also equipped to build special machinery for any purpose.

Mr. C. W. Thomas, Detroit, Mich., successor to the Michigan Brass & Iron Works, is sending out his catalogue A, which contains an illustrated list of sizes and prices of brass gate and radiator valves of various designs.

A number of general and detail views of installations of the traveling electric hoists made by Pawling & Harnischfeger, Milwaukee, Wis., are shown in their Bulletin No. 16. In addition to many standard types of cranes, this firm builds special machines to meet particular requirements, and illustrations of several of these special cranes in service are shown in their bulletin.

The history of flange joint packing has been closely identified with and influenced by that of steam service, and as the temperatures and pressures have increased continual improvements in flange gaskets have been necessitated. The advantages of asbestos for this purpose are described in an illustrated pamphlet on flange joint gaskets, issued by the H. W. Johns-Manville Co., 100 William St., New York, which contains a complete list of sizes and prices.

The thirty-fourth edition of the catalogue of the Abendroth & Root Mfg. Co., New York, contains a number of illustrations which show the arrangement and construction of the Root water-tube boiler. Views of a number of buildings and industrial plants equipped with these boilers and several pages of information and tables of value to designers and operators of steam power plants are also included in the catalogue.

A pamphlet has been received from the H. W. Johns-Manville Co., 100 William St., New York, which describes various forms of asbestos and 85 per cent. magnesia pipe and boiler coverings. The use and value of these coverings for both steam and hot water pipes and to protect pipes from freezing are discussed.

The 1905 catalogue of the St. Louis Expanded Metal Fireproofing Co., Century Bldg., St. Louis, is a profusely illustrated book of 168 pages, containing many valuable articles on reinforced concrete construction and design. The introduction has some interesting arguments for the use of steel with a high elastic limit in such work and also on the bond between corrugated bars and concrete. The rules and tables for the design of beams and floors are unusually complete and enable any one to apply readily the system of design recommended by Mr. A. L. Johnson.

A brief, but clearly illustrated description of some of the fireproof construction employed in the new buildings of the United States Naval Academy, Annapolis, is given in a pamphlet recently issued by the Clinton Wire Cloth Co., Clinton, Mass.

The Wagner Electric Mfg. Co., St. Louis, Mo., has issued a folder describing a type of 60-cycle, single-phase induction motors for elevator, hoist and traveling crane service. These are made in all standard sizes up to 25 h.p.

The Chicago Portland Cement Co., Stock Exchange Bldg., Chicago, has issued an unusually artistic folder containing a view of the concrete arches in the east approach to the Thebes, Ill., railroad bridge and views of two recently built reinforced concrete highway bridges.

The apparatus manufactured by the New York Blower Co., of Bucyrus, O., and Chicago, for hot blast systems of heating and ventilating factories and public buildings, forms the subject of the company's publication No. 55. Cuts of various types of the apparatus and of a few typical installations accompany the description.

The Simplex Concrete Piling Company, Philadelphia, Pa., has issued a booklet containing a detailed description, accompanied with drawings, of the method of driving and placing concrete piles by the Simplex system, and the advantages claimed for that system wherever artificial foundations are required. The booklet also contains a large number of views of the more difficult conditions under which foundations have been made of concrete piles driven by the Simplex system.

The 1905 digging machinery catalogue of the Hayward Co., 97-103 Cedar St., New York, gives illustrated descriptions of different types of orange peel, clam-shell, bottom-dump, turn-over and scoop dredging and excavating buckets. More than half the catalogue, which is large and well printed, contains views and descriptions of the widely varying uses to which this class of excavating machinery has been adapted.

The Dixon Garbage Crematory Co., Spitzer Bldg., Toledo, O., received a grand prize from the Louisiana Purchase Exposition for the two 30-ton Dixon garbage crematory plants which disposed of the garbage collected in the exposition grounds. A description of this plant and the results obtained in it, with similar descriptions of municipal plants in this country, is given in a pamphlet just published.

An illustrated description of the different types of the concrete steel fireproofing system of the American Concrete Steel Co., Newark, N. J., is given in the recent catalogue of that company. The catalogue also contains a number of views of the larger buildings in which the floors and roofs have been designed according to this system.

Church lighting is a feature of engineering work which presents several special problems. The illumination must be such that it has no dazzling effect on the eyes of the congregation, and the shape of the church makes this requirement one which low-hanging chandeliers and wall-brackets fail to satisfy in most cases. The Nernst Lamp Co., Pittsburg, has been making a specialty of lighting installations and has prepared a booklet on the subject which contains much interesting information.

The Green Fuel Economizer Co., Matteawan, N. Y., has prepared a long list of the sales of Green economizers in New England since 1892. There are about 175 names on the roll, and many of them are down for several equipments, such as B. B. & R. Knight for eleven, Boston Elevated Ry. seven, and American Thread Co. seven.

Catalogue No. 2 of the National Wood Pipe Co., Los Angeles, Cal., contains descriptions of the methods of making wooden stave pipe of both the machine banded type, made under the Woodward patent in sizes of 3 to 18 in., and for pressures up to 300 lb. and the Wheeler patent continuous stave type, from 10 in. to 10 ft. in diameter and specially adapted for general irrigation work and water power systems. The relative cost, life and carrying capacity of wooden stave and other kinds of pipe are discussed in detail, and 44 pages of useful tables of discharge quantities, friction losses, velocity, etc., of water flowing in wooden stave pipe are given.

The Riehlè Bros. Testing Machine Co., Philadelphia, Pa., has issued in a large pamphlet a number of sheets supplementary to the new edition of its catalogue. These contain illustrated descriptions of testing machines and accessory apparatus recently designed for special purposes.

The catalogue of the Lawrence Cement Co., Siegfried, Pa., contains a considerable amount of useful information regarding the properties of Portland cement and methods of testing it. Valuable suggestions on mixing mortar and concrete and the results of tests made on Dragon Portland cement by a number of railroad and government engineers add to the value of the book.

A pamphlet containing an interesting account of the methods used in the manufacture of bright tin plates has been issued by Merchant & Co., Inc., Philadelphia, Pa.

The Westinghouse Electric & Mfg. Co. has prepared two attractive booklets concerning fan motors. One of these refers to direct-current types for desk and wall service. The shape of the blades has been very carefully studied for the 1905 fans and considerably modified from earlier forms, the purpose of the changes being to give an even breeze across the entire front of the fan. A 12-in. fan of this type is stated to run on less current than a 16-c.p. lamp. The second pamphlet describes alternating-current fans, in which there are new improvements to improve the starting qualities.

A valuable book on hoisting machinery has been published by the Eastern Press for the Rawson & Morrison Mfg. Co., Cambridgeport, Mass. The contents cover electric, steam and belt hoists, cableway engines and boilers, and a great many varieties are illustrated under each head. The construction of the machines is explained in detail, and their peculiar field of usefulness is explained so carefully that the book is of unusual technical value.

A very complete discussion of the occurrence and uses of Rhine trass has been published by Anton Hambloch, Andernach a. Rhein, Germany. Engineers familiar with the German language will find in the book a great number of data concerning the properties of various mixtures of trass with lime and cement.

The Hancock Inspirator Co., New York, has published a handsomely printed catalogue of its various products. The method of operation and of connecting up the Hancock inspirator, now 29 years old, is fully described. The different details and purposes of the several types of locomotive and stationary inspirators are pointed out, and there are many tables of capacities of the various sizes of each type, and also of the boiler washer and ejector made by the company. The section of the book devoted to main steam valves of various patterns, check valves and blow-off valves is closed with a full description of the new globe, angle, sixty-degree and cross valves, in which the internal parts are given an unusual shape in order to increase their strength and rigidity. The book ends with a description of the Hancock whistles, hose strainers and couplings, pneumatic cylinder cocks and oil cups.

The Kinnear-Hood Steel Co., 141 Broadway, New York, has published a new catalogue of its radiators made of sheet metal for use with either steam or hot water. They are made of brass, bronze, copper and steel, and several special advantages are claimed for them on acount of the thinness of their shells and the amount of their radiating surface per square foot of floor occupied.

The Allentown Rolling Mills, Allentown, Pa., has issued in catalogue No. 7 a full description of the various types of electric pumping machinery designed by Roscoe H. Aldrich. The catalogue is unusually explicit concerning their details of construction, while the information regarding the special merits of different types is so full as to be particularly useful to engineers who have never looked into this subject. The pumps are made in a great variety of sizes and for purposes ranging from shaft sinking to deep mine pumping.

BUSINESS NOTES.

The York Mfg. Co., York, Pa., reports the following among recent orders: Hazen Confectionery Co., Boston, Mass., 20-ton refrigerating plant; J. Fred Schmidt, Columbus, O., 10-ton refrigerating machine; Fleckenstein Bros., Jersey City, N. J., 10-ton refrigerating plant; Consolidated Ice Co., Pittsburg, 175-ton compression side; E. H. Dellenbach, Allegheny, Pa., 10-ton refrigerating plant; M. E. Maggart, Clyde, Kan., 10-ton refrigerating and 2-ton ice-making plant; Westerberg & Williams, New York, 20-ton refrigerating plant for Balch, Price & Co.; University of Illinois, Urbana, 10-ton refrigerating and ice-making plant for experimental purposes; Indio, Cal., Water, Light & Ice Co., 6-ton ice-making plant; Consumers' Ice & Fuel Co., Lexington, Ky., 90-ton compression side and 35-ton ice-making plant; Kugler Restaurant Co., Philadelphia, 20-ton refrigerating plant; W. H. Koughan, McKeesport, Pa., 10-ton refrigerating and 3-ton ice-making plant; Sanitary Ice & Cold-Storage Co., Johnstown, Pa., two 45-ton machines; L. J. Metcalf, Elizabethtown, Ky., 10-ton ice-making and refrigerating plant; Agar, Cross & Co., New York, 30-ton refrigerating plant and a 2½-ton compression side for shipment to Buenos Aires; Waygood Elevator Co., Sydney, N. S. W., 1½-ton, 3-ton and 6-ton compression sides; Jacob Dold Packing Co., Buffalo, N. Y., 10,000 ft. of 2-in. direct expansion piping.

The Cooper Hewitt Electric Co. has recently issued bulletins describing its direct-current mercury vapor lamps and recent installations of them; one pamphlet particularly describes the lighting equipment of printing establishments and contains testimonials from a number of printing firms using the mercury vapor lamps in their composing and press rooms. The company announces that it is now placing on the market the Cooper Hewitt mercury vapor converter for charging storage batteries from alternating current circuits. A bulletin describing these converters will shortly be ready for distribution. Announcement is also made that they will soon have ready for commercial use their mercury vapor lamp for operation on alternating current circuits.

The Stanley Electric Manufacturing Co. and the General Incandescent Arc Light Co. have consolidated. The corporate title of the combined interest will be Stanley-G. I. Electric Manufacturing Co. The Stanley Company as engineers and manufacturers of the well-known S. K. C. system have acquired the reputation of turning out only superior electrical apparatus. The General Incandescent Arc Light Co. have been builders of high-grade arc lamps, incandescent lamps, alternating and direct current motors and general electrical supplies. The engineers of this concern have for years made a special study of electric lighting. The officers of the new company are as follows: Wm. Murray Crane, president; C. C. Chesney, first vice-president; M. D. Barr, second vice-president; M. J. Insull, third vice-president.

The Wisconsin Light & Power Co. of La Crosse, Wis., have placed orders with the Westinghouse companies covering the entire equipment of a large light and power plant. Besides two 400-kw. alternating current generators driven by Westinghouse-Parsons steam turbines, there are three Westinghouse vertical steam engines, one of which will be connected to a 25-kw. direct current generator. The order also includes two 7½-kw. motor-generator sets, five transformers, a switchboard, lightning arresters, choke coils and incandescent lamps. Roney stokers will be used in the boiler installation. The activity in the application of motors to cranes, hoists and machine tools of every description is indicated by several orders entered during the week as follows: The Morgan Engineering Co., eight railway type crane motors with a total of 250 h.p.; the Pond Machine Tool Co., twenty-eight induction motors; Niles Tool Works, five direct current motors; Long & Allstatter Co., thirteen motors; the Delaware, Lackawanna & Western R. R., twenty induction motors; U. S. Hoe & Tool Co., eight motors; the Austin Powder Co., ten induction motors.

The month of April has been one of the biggest in the history of the Allis-Chalmers Co., the orders taken amounting to about $2,000,000. One of the large contracts secured was for the extension of the plant of the San Joaquin Power Co. in California. Besides the hydraulic turbines for producing this power, the additional machinery will consist of two 1,000-kw. Bullock water wheel type generators; 350-kw. transformers with exciters and other electrical machinery. Important orders have been received by Allis-Chalmers Co. during April for mining machinery for South Africa, where the long expected revival of trade subsequent to the Boer war seems now to be making itself felt.

The American Graphite Co., South Bend, Ind., has incorporated with a capital stock of $300,000, to manufacture graphite. Adam Huntsburger and Wm. Clem, directors.

Orders for eight turbo-generators were placed with the Westinghouse Electric Mfg. Co. lately, ranging from 400 to 2,500 kw. in capacity. The United Electric Light & Power Co. of New York has ordered a motor-generator set having a 1,400-h.p. induction motor and a 1,000-kw. revolving field A. C. generator, with an automatic regulating control outfit. On the same day this order was received, orders also came in for 104 induction motors of ½ to 350-h.p. capacity. The Pittsburg Reduction Co. will install two D. C. 2,200-kw. 500-volt generators to run at 140 r.p.m. Among recent railway orders may be mentioned one from the Transit Development Co. of Brooklyn for 204 type 101 B motors.

Among the participants in the large orders for railroad equipment let by the B. & O. R.R. Co. this week is the American Steel Foundries. They will furnish the Baldwin Locomotive Works, for 250 B. & O. locomotives, approximately 15 tons of steel castings for each engine, including engine frames, driving wheel centers, cross heads, driving boxes, etc. Another large order recently received by the American Steel Foundries calls for 3,000 R. E. Janney couplers to be applied to 1,500 cars to be built by the Pressed Steel Car Co. for the Chesapeake & Ohio Ry., and an order for 6,000 of these couplers for application to 3,000 Lehigh Valley cars has also just been awarded them. To take care of the increasing business, they are making additions and improvements to their various plants, and hereafter will be better equipped than ever to handle their business.

In connection with the work on the Pennsylvania R.R. crosstown tunnels, the United Engineering & Contracting Co. has removed its offices to 32 East 33d St., New York, which will be its general offices.

The New York Continental Jewell Filtration Co. reports the following among recent sales of filters: Parkersburg, W. Va., Brewing Co.; Grafton, W. Va., Grocery Co., bottling; office building at 439 N. 10th St., Philadelphia; Penn'a Railroad Co., Philadelphia; Hopkins Place Savings Bank, Baltimore, Md.; residences of J. A. Reynolds, New York City; John L. Arnold, Lancaster, Pa., and F. R. Chambers, Bronxville, N. Y.; Hudson River Aniline Color Works, Rensselaer, N. Y.; Chase Rolling Mills, Waterbury, Conn.; Ingersoll-Sergeant Drill Co., for East River tunnel stations at foot Flushing St., L. I. City, and foot of East 32d St., N. Y. City.

The Abner Doble Co., of San Francisco, announces that arrangements have been made with the John McDougall Caledonian Iron Works Co., Limited, Montreal, Can., whereby the latter become sole licensees for the manufacture of the Doble system of water wheels in the Dominion of Canada. Considerable interest, the company states, has recently been shown in relation to the four 8,000-h.p. wheels which it has built for operation in California power plants. The McDougall Company has extensive machine works in Canada, the plant including machine shops, pattern shop, foundry, forging works and structural material. The plant is therefore well equipped for the manufacture of water wheels and other hydraulic machinery. The McDougall Co. already has in hand the building of a 100-h.p. wheel to operate under 170 ft. head, taking water through a 3½-in. jet and having a speed of 130 r.p.m. The Canadian licensees are prepared to furnish the steel pipe, structural work and all machinery necessary for complete power plants and have retained the Abner Doble Co. as their consulting engineers.

The Contractors' Equipment Co., of Philadelphia, has moved its offices to 2126 Land Title Bldg.

The C. O. Bartlett & Snow Co., Cleveland, Ohio, is rapidly recovering from the effects of the fire in its plant and is executing its contracts with little or no loss of time, being practically in full working condition again.

Cooper & Evans, general contractors, have opened an office at 220 Broadway, New York, which will hereafter be their headquarters.

A. P. Head, the London representative of the Wellman-Seaver-Morgan Co., has just completed a tour around the world and has established the following sub-agencies for the Wellman-Seaver-Morgan Co.: Australian Metal Co., Melbourne, as Australian agents; the branches of this concern are as follows: The Gilbert Machinery Co., Wellington, New Zealand; James Stothert, Brisbane, Queensland; James Croker, Mackay, N. Queensland; W. R. Laidley, Sydney, New So. Wales; James C. Fraser, Adelaide, So. Australia; A. E. Thomas, Koolgardie, W. Australia; Lindsay Tullock, Launceston, Tasmania. In India the following agents representing the presidencies of Bombay, Bengal and Madras have been appointed: J. Harper, Calcutta; Frank Harrison, Bombay; W. H. Oakes, Madras.

The Vulcan Iron Works Co., of Toledo, O., has just shipped three more "Little Giant" steam shovels to South Africa. The company has in the past shipped quite a number of this type of shovel into the diamond fields in the Kimberly district and has reports from their work in that territory which are gratifying.

The Bellefontaine, O., Foundry & Machine Co. reports the sale of the following steam dredges recently: Three for shipment to Missouri; two for parties in Minnesota and one for shipment to Indiana. Four of these machines are the company's special No. 5 dredge.

Contracts have been placed with Wm. B. Scaife & Sons Co., Pittsburg, Pa., for a steel-frame trestle to be erected at Bellefonte, Pa., for the American Lime & Stone

Co.; also for a steel-frame tipple about 400 ft. long for its Buffalo Run plant.

The Southern Contracting Co., Norfolk, Va., has been awarded contract by Jas. Stewart & Co., of Pittsburg, general contractors for the 12-story Commercial Realty Co. Building in Norfolk, for the fireproofing, ceilings and floors, the expanded metal system.

The Merchant & Evans Co., 517 Arch St., Philadelphia, announces that it has purchased from Merchant & Co., Inc., all its property and assets and assumed all its debts and liabilities. Mr. Powell Evans, who has been vice-president of Merchant & Co. for a number of years and the company's president for the past year, has organized and controls and is president of the new company. The old organization and personnel of the company remains unchanged.

PERSONAL NOTES.

Mr. Frank Shutts has been appointed city engineer of St. Charles, La.

Mr. Ira W. Sylvester has been elected city engineer of Alexandria, La.

Mr. Frederick L. Ford has been re-appointed city engineer of Hartford, Conn.

Mr. David Morey has been appointed superintendent of the Troy, N. Y., water works.

Mr. Oscar Erlandsen has resigned as assistant engineer in the department of bridges, New York City.

Mr. Louis P. Wirthwein, an assistant city engineer at Columbus, O., died May 2, at his home in that city.

Mr. Joseph W. Hunter has been appointed State highway commissioner of Pennsylvania for a four-year term.

Mr. Lamar Lyndon has removed his offices from the Park Row building, to 80 William Street, New York City.

The Hon. James Sutherland, minister of public works in the Canadian cabinet, died, May 2, at Woodstock, Canada.

Mr. Peter E. Van Buskirk, borough engineer of Rutherford and Oradell, N. J., died at his home in Rutherford, April 27.

Mr. H. S. Jaudon has been appointed engineer in charge of the construction of a sewerage system at Quitman, Ga.

Messrs. French and Russell, consulting and supervising engineers, have opened an office in the Moffat Building, Detroit, Mich.

Mr. D. D. Thorp has retired as water commissioner of Detroit, Mich., and Mr. John F. Dodge has been appointed to succeed him.

Mr. William A. Eitelmann, superintendent of construction for Mr. H. D. Thomas, of Baltimore, died April 30, at Baltimore.

Mr. J. H. Fildes, master mechanic of the Lehigh Valley Ry., at East Buffalo, N. Y., has resigned and will be succeeded by Mr. F. W. Cooper.

The Municipal Civil Service Commission of New York City will hold an examination, May 25, of candidates for the position of architect in the municipal service.

Mr. F. B. Leopold has resigned his position with the New York Continental Jewell Filtration Co., and become general manager of the Pittsburg Filter Mfg. Co.

Mr. William G. Mather, president of the Cleveland-Cliffs Iron Co., delivered the class day address, May 5, to the graduates of the Michigan College of Mines.

Mr. Irwin B. Hosig, of Wisconsin, has been appointed hydrographic aid in the U. S. Reclamation Service and will report to Mr. S. B. Robbins at Great Falls, Mont.

Mr. J. P. Hallihan has been appointed chief engineer and assistant to the president of the Rio Grande, Sierra Madre & Pacific Ry., with headquarters at El Paso, Tex.

Mr. C. E. Drummond has been appointed assistant engineer of the Oregon Short Line Ry., and will have charge of the construction of the Malad Branch of that road.

Mr. H. M. Geer has resigned as engineer in charge of the construction of the sewerage system and disposal plant at Ballston Spa, N. Y., to accept a position at Fairfield, Me.

Mr. Ira G. Hedrick, of Waddell & Hedrick, consulting engineers, Kansas City, Mo., has been conferred with the degree of Doctor of Science by McGill University, Montreal, Canada.

Mr. Morton H. Anderson has resigned as assistant superintendent of the Reliance works of the Allis-Chalmers Co. to accept a position with the De La Vergne Machine Co., of New York.

Mr. P. S. Fitzgerald, assistant engineer on the Southern Ry., has become engineer of maintenance of way of the western district of that road, with headquarters at Birmingham, Ala.

Mr. W. H. Kennedy has resigned as chief engineer of the Oregon Railroad & Navigation Co., and will be succeeded by Mr. G. W. Boschke, assistant engineer on the Southern Pacific R. R.

Mr. Andrew B. Larson, of Utah, has been appointed engineering aid in the U. S. Reclamation Service and assigned to duty, under District Engineer G. L. Swendsen at Salt Lake, Utah.

Mr. Fred Giddings has been reappointed city engineer of Atchison, Kan. Mr. Giddings was first appointed to his present position in 1885 and, with the exception of one year, has held the office since then.

Mr. W. L. Gilmore has resigned as superintendent of motive power on the New York, Chicago & St. Louis Ry. and will be succeeded by Mr. E. A. Miller, master mechanic on that road at Conneaut, O.

Mr. J. A. Cheney has been appointed general manager of the East Berlin, Conn., plant of the American Bridge Co., to succeed Mr. E. W. Stearns, who recently resigned to accept a position with the New Jersey Bridge Co.

Mr. D. L. Ellis, city engineer and engineer of the water-works department of Great Falls, Mont., has retired to take up the active management of the Ellis-Ford Pipe Cutter Co., and will be succeeded by Mr. George W. Bird.

Mr. Job M. Leonard, a pioneer iron and steel manufacturer, died, May 8, at his home in Fall River, Mass. Mr. Leonard formed the Bridgewater Iron Co. in 1850 and in 1855 organized the Mt. Hope Iron Works at Somerset, Mass.

Mr. Waldo S. Coulter, of Massachusetts, and Mr. Arthur B. Dodd, of California, have received appointments as assistant engineers in the U. S. Reclamation Service and will be engaged under Mr. Andrew Weiss at Fort Laramie, Wyo.

Mr. H. C. Van Buskirk, general master mechanic of the Fort Worth & Denver City R. R., at Childress, Tex., has been appointed superintendent of motive power of the Colorado & Southern R. R., with headquarters at Denver, Colo., to succeed Mr. A. L. Studer, who has resigned.

Mr. William Carroll, first assistant city electrician of Chicago has been appointed city electrician to succeed Dr. Edward B. Ellicott, whose resignation to become principal engineer of the Chicago drainage canal in charge of water power development was recently noted in this column.

Mr. W. A. Van Frank, engineer of the Missouri division of the Chicago, Rock Island & Pacific Ry., has been transferred to the Kansas division of that road, with headquarters at Topeka, Kan. Mr. E. M. Case, engineer of the El Paso division, has been appointed to succeed Mr. Van Frank, with headquarters at Trenton, Mo.

Mr. Ray S. Blinn has been appointed assistant engineer in the U. S. Reclamation Service and will have headquarters at Mitchell, Neb., under Mr. Sam G. Porter. Mr. Ray S. Carberry, recently appointed assistant engineer, and Mr. Paul Rothi, engineering aid in the Reclamation Service, will also report to Mr. Porter at Mitchell.

Mayor Ralph Dunning, Corps of Engineers, U. S. A., retired, died at his home, Brooklyn, N. Y., May 4. Major Dunning was connected with the construction of a number of the early seacoast fortifications at Savannah, Ga., Mare Island and San Francisco, Cal. He was stationed in Washington when he retired about twenty-five years ago.

Mr. Robt. O. Hayt, of New York, has been appointed assistant engineer in the U. S. Reclamation Service and has reported to Mr. H. N. Savage at Billings, Mont. Mr. Alfred L. Coupe, recently appointed engineering aid in the Reclamation Service, will also be stationed at Billings, under Mr. W. E. Swift.

Mr. A. H. Perkins has received an appointment as engineer in the U. S. Reclamation Service by transfer from the Philippine service and will report to Mr. Cyrus C. Babb at Browning, Mont. Mr. Ernest J. Fisher and Mr. Jos. I. Bingham, recently appointed engineering aids in the Reclamation Service, have also been ordered to report to Mr. Babb at Browning.

The following officers have been elected by the recently organized Engineers' Club, of Baltimore, Md.: President, D. D. Carother; Vice-Presidents, Mr. Alfred M. Quick and Mr. N. H. Hutton; Secretary, Mr. Charles E. Phelps, Jr.; Treasurer, Mr. Charles C. Reeder; Board of Directors: Messrs. Benjamin T. Fendall, Janon Fisher, C. O. Vandevanter, William T. Manning, James H. Harlow and Major Joseph W. Shirley.

Mr. Robert M. Whitehouse, a mechanical engineer of wide experience, died recently at Dover, N. H. Mr. Whitehouse was connected with the early railroad shops in New England and later was employed by the Russian government to take charge of the rolling stock of the Nicolai Ry., between St. Petersburg and Moscow. He returned to this country in 1862 and was afterward a member of Genesee Iron Works Co., of Flint, Mich., for a number of years.

Captain William P. Wooten, Corps of Engineers, U. S. A., has been ordered to Dallas, Tex., for duty in connection with the proposed improvement of Trinity River. Captain Wooten has been engaged in work on the water supply system of the District of Columbia and the improvement of the Potomac River. He has been in direct charge of the construction of the Washington filtration plant and will not be transferred until the condition of that work justifies his permanent absence.

Major Geo. M. Wheeler, Corps of Engineers, U. S. A., retired, died in New York, May 3. Major Wheeler graduated from the U. S. Military Academy with the class of '66, and was connected with various government engineering works from that time until he was appointed superintendent of the geographical survey of the United States west of the one hundredth meridian, which was completed under his direction in 1884. He was appointed commissioner of the United States and delegate from the War Department to the third international Geographical Congress and Exhibition at Venice in 1881, and was retired in June, 1888, for disability contracted in line of duty.

Mr. Albert S. Crane has accepted a position as chief hydraulic engineer for J. G. White & Co., Inc., of New York City. Mr. Crane graduated from Cornell University in 1891, and was employed in various kinds of hydraulic work until he was appointed chief assistant engineer of the Michigan & Lake Superior Power Co., at Sault Ste. Marie, Mich., in 1898. He was later appointed chief engineer of the Lake Superior Power Co., at Sault Ste. Marie, and since 1902 has been principal assistant engineer of the Sanitary District of Chicago, in charge of the design and construction of the power station on the Chicago Drainage Canal at Lockport, Ill., under the direction of Mr. Isham Randolph.

The Board of Direction of the American Society of Civil Engineers announced at the regular meeting, May 4, that the following candidates for admission had been elected: As Member.—George Berry, Asst. Engr. Bureau of Highways, Dept. of Public Works, Brooklyn, N. Y.; Louis L. Brown, General Superintendent for The Foundation Co., New York City; Josè A. Canals, City Engr., San Juan, Porto Rico; Edward I. Cantine, Div. Engr., D., L. & W. R. R., Hoboken, N. J.; Frederick J. Easterbrook, Asst. Engr., on construction, N. Y. N. H. & H. R. R., New Haven, Conn.; Hector J. Hughes, Asst. Prof. in charge of Hydraulics and Sanitary Engineering, Lawrence Scientific School, Harvard Univ., Cambridge, Mass.; James A. Jamieson, Cons., Designing and Contr. Engr., Montreal, Que.; Henry Japp, Managing Engr. and Director, S. Pearson & Co., Inc., New York; James B. Marsh, Pres. and Chf. Engr., Marsh Bridge Co., Des Moines, Ia.; Lardner V. Morris, Engr. in Charge, Bay Ridge Improvement, Long Island R. R., Brooklyn, N. Y.; Wm. N. Page, Chf. Engr., The Deepwater Ry. Co., Ansted, W. Va.; F. A. C. Perrine, Cons. Engr., New York City; Alfred Phillips, Prof. of Civ. Eng., Armour Institute of Technology, Chicago, Ill.; Wm. H. Puffer, Guanajuato, Mex.; Chas. A. Van Keuren, Chf. Engr., Municipality of Jersey City, N. J.; John Van Vleck, Mech. Engr., Interborough Rapid Transit Co., New York City. As Associate Member.—Carl L. Bannister, Asst. Engr., New York State Engr's. Dept., Rome, N. Y.; Carroll Blake, with Virgil G. Bogue, Cons. Engr., New York City; John P. Congdon, Div. Engr., Idaho Div., Oregon Short Line R. R., Pocatello, Idaho; Keith O. Guthrie, Chf. Engr. and Mgr. for Henry Dumary, General Contractor and Builder, Brooklyn, N. Y.; Chas. E. Howe, Treas. Wabash Mfg. Co., Wabash, Ind.; Harold W. Hudson, Asst. to Asst. Engr., Philadelphia Div., Pennsylvania R. R., Harrisburg, Pa.; Edward C. Jansen, Senior Engr. Asst., Municipal Engr's office, Shanghai, China; Bouidnot G. Leake, Asst. Engr., C., R. I. & G. Ry., Fort Worth, Tex.; Walter R. Lewis, Jr., Asst. Supt., River Div., Denver Union Water Co.; address Littleton, Colo.; Carlos Lobo, Asst. Engr., Dept. of Water Supply, Gas and Electricity, Borough of Brooklyn, New York City; Elbert E. Lochridge, Engr., Water Dept., Springfield, Mass.; Ernest Manchester, Asst. Engr., 2d Grade, Melbourne & Metropolitan Board of Works, Melbourne, Australia; Arthur E. Owen, Asst. to Chief Engr., Central R. R. of New Jersey, N. J.; Herbert L. Rogers, Draftsman, Engr.'s office, Dept. of Docks & Ferries, New York City; Fred W. Sarr, Res. Engr., Middle Div., Dept. of State Engr. and Surv., Syracuse, N. Y.; James E. Torrey, Asst. Engr., Central R. R. of New Jersey, Montclair, N. J.; Richard W. Tull, Asst. Engr. in office of C. C. Schneider, Philadelphia, Pa.; Wm. P. Wooten, Capt. Corps of Engineers, U. S. A., Washington, D. C.; Samuel F. Miller, Contr. Engr., Steel and Iron Construction, New York City; Chas. L. Spier, Secy. and Treas. and Asst. to Pres., Richmond Light & R. R. Co.; Pres., Staten Island Midland R. R.; Vice Pres., New Jersey & Staten Island Ferry Co.; Pres., Sea Coast Traction Co.; New York City. The following candidates announced elected as Juniors: Ernest S. Ball, New York City; John C. Fruit, New York City; Linn M. Huntington, Culebra, Canal Zone, Panama; Harry G. Raschbacher, Washington, D. C.; Carl H. Reeves, Seattle, Wash.; Albert O. Smith, Livingston Manor, N. Y.; Roy Swartwout, Tecumseh, Neb.; Joseph C. Schaeffler, Somerville, Mass.; Arthur C. Tozzer, New York City. The following candidates were announced transferred from the grade of Associate Member to Member by the Board of Direction: Alfred D. Flinn, New York City; John Flynn, Jr., Troy, N. Y.; Charles W. Leavitt, Jr., New York City; Edwin M. Scofield, Philadelphia, Pa.; Henry F. Wilson, Jr., Birmingham, Ala.

CONTRACTING NEWS
OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Lonoke, Ark.—It is reported that Bransford & Daniels, owners of the water works, will erect a new standpipe and replace the water mains with 4-in. pipe.

Whittier, Cal.—Bids will be received until June 12 for furnishing c. i. pipe, riveted steel pipe and screw casing pipe f. o. b. Whittier. Separate bids will also be received at the same time for constructing a 12-in. inner diameter well, 600 ft. deep; also for furnishing and installing the following machinery: Water-tube boilers, steam pump, pumping engine, air compressor, boiler-feed pump and oil set for boiler feed, all 3 proposals advertised in The Engineering Record.

**Alamosa, Colo.*—Frank Blake, of La Jara, is stated to have secured the contract for building the tunnel in connection with the reservoir on Alamosa River, for $16,000 for irrigation purposes.

Pasadena, Cal.—It is reported that bids will be received May 16 by H. Dyer, City Clk., for the purchase of $931,250 municipal water bonds.

Wilmington, Del.—Bonds to the amount of $200,000 for the city's new water works were sold May 1.

The T. A. Gillespie Co. of New York, N. Y., and Pittsburg, Pa., is stated to have secured the contract for furnishing steel pipe for water mains needed in connection with the new water works (bids opened May 1) for a total of about $136,376.

Ocilla, Ga.—See "Power Plants, Gas and Electricity."

**Columbus, Ga.*—Perry Andrews, of Atlanta, is reported to have secured the contract for sinking a 10-in. artesian well at $8 per ft. for a depth not exceeding 600 ft. The boring of this well near Columbus will be an effort to settle the water supply question. The city has already issued $250,000 bonds for building water works.

Princeton, Ky.—Engr. Granberry Jackson, of Nashville, Tenn., writes that it is proposed to secure a new water supply at Princeton, at a cost of from $35,000 to $40,000, but detailed plans have not yet been prepared.

Kewanna, Ind.—The Kewanna Water Co. is reported formed with a capital of $15,000. Dr. A. Armstrong, Pres.

Muskogee, Ind. Ter.—See "Schools."

Lone Tree, Ia.—The Council is reported to be considering the cost of constructing water works.

Sterling, Kan.—The citizens are reported to have voted to issue $5,000 bonds to install a new pump and otherwise improve the water works.

Kansas City, Kan.—Press reports state that Mayor W. W. Rose will ask City Council to employ an engineer to prepare plans and make survey for new water works for the city, the plans to be used for guidance of city in granting a water works franchise.

New Orleans, La.—The Sewerage and Water Bd. (Geo. G. Earl, Gen. Supt.) has awarded contracts as follows (bids opened Apr. 18):

*Contract "1-W," Pumping Machinery.—Allis-Chalmers Co., of Milwaukee, Wis., secured this contract at the following bid: 4 20,000,000-gal. high lift engines, 218-ft. head, $287,600; 3 40,000,000-gal. low lift centrifugal pumps, 15-ft. head, $10,900; 1 20,000,000-gal. low lift centrifugal pump, 12-ft. head, $2,530; 3 engines for 40,000,000-gal. centrifugal pumps, $16,500; 1 engine for 20,000,000-gal. centrifugal pump, $4,300; 2 150-kw. d. c. generators and switchboard, $8,000; 2 engines to operate electric generators, $13,350; 6 400-hp. water tube boilers, $30,700; economizer, $6,700; superheaters, $8,000; stokers, $10,300; 2 electric traveling cranes, 12,400; water pipe connections, etc., $37,700; and for all other items, $31,000; total, $479,898. The other bidders were Wm. Tod Co., Youngstown, O., $482,000; Holly Mfg. Co., Lockport, N. Y., $496,605, and Providence Eng. Wks., Providence, R. I., $542,000.

*Contract "2-W," Pipe.—The U. S. Cast Iron Pipe & Fdy. Co., of Chattanooga, Tenn., secured this contract at $24.50 per ton for 6,300 tons 48-in. pipe, and same price for 200 tons of 4 to 30-in., and $65 per ton for 20 tons special castings; total bid, $160,550. The other bidder for this work was the Camden Iron Wks., Philadelphia, Pa., for $178,950.

*Contract "3-W," Pipe.—The U. S. Cast Iron Pipe & Fdy. Co. secured the contract for all straight pipe required, which is 6,300 tons of 30, 24, 20, 16 and 12 to 4-in. at $22.43 per ton, and 150 tons special castings, $50 per ton; total bid, $148,809. The other bidders were: The Dimmick Pipe Co., Birmingham, Ala., $163,995; Glamorgan Pipe & Fdy. Co., Lynchburg, Va., $177,470, and Camden Iron Wks., $181,050.

*Contracts (*a*) "4 W" and (*b*) "5 W," Weathford & Cary Bros., Memphis, Tenn., secured both these contracts (*a*) $87,437, (*b*) $93,199. The other bidders are: Irwin Bros., New Orleans, *a* $102,033, *b* $98,401; A. L. Patterson & Co., Macon, Ga., *a* $106,210, *b* $97,638; R. C. Storrie, New Orleans, *a* $109,456, *b* $112,055; T. J. Shea, New Orleans, *a* $117,945, *b* $126,419; McGovern Constr. Co., Trenton, N. J., *a* $119,887, *b* $103,435; J. H. McKnight, *a* $124,690; W. O. Burton, New Orleans, *a* $134,529; Southern Constr. Co., Macon, Ga., *b* $99,476. The work in connection with these two contracts includes the laying of about 94,100 lin. ft. pipe, furnishing valves, hydrants, plugs, laying pavement, etc.

McDonoghville, La.—H. L. Zander, Co. Engr., is reported to have completed plans for constructing water works for this town. He estimates the cost at $24,045. A stock company will probably be formed to install the plant.

Donaldsville, La.—The citiizens are reported to have voted to issue $31,000 bonds for enlarging and extending the water works and improving the streets and sidewalks.

**Boyce, La.*—A. B. Sanders, of Shreveport, has secured the contract for constructing water works for $16,000. Engineer, Ira W. Sylvester, of Alexandria.

Portland, Me.—Bids will be received May 27 by Capt. A. W. Yates, Constr. Q. M., U. S. A., 187 Middle St., Portland, for constructing roads at Ft. McKinley, Me., and additional water mains and fire hydrants at Ft. Williams, Me.

Boston, Mass.—The Common Council is reported to have appropriated $330,000 for the construction of new and the replacing of old water pipes.

**Haverhill, Mass.*—The Platt Iron Wks., of Dayton, O., has secured the contract for installing a pump at Kenoza Lake pumping station, for $18,750. It will have a daily capacity of 7,500,000 gal.

Mattapoisett, Mass.—A petition is being circulated for an extension of the mains of the Fairhaven Water Co. (Jos. K. Nye. Supt. Fairhaven) through this town.

Hubbell, Mich.—The State Legislature is stated to have authorized this village to issue $30,000 bonds for water works.

**Thief River Falls, Minn.*—The following are the bids opened May 1 for the construction of (*a*) water works (*b*) sewerage system. (Engineer Oscar Claussen, St. Paul.): W. S. Weeks, *a* $21,550, *b* $19,559; Des Moines Bridge & Iron Wks., *a* $19,300, *b* $15,100; Crowley Elec. Co., *a* $19,300, *b* $15,300; Jas. Kennedy, *b* $17,091; Chris. Johnson, *b* $13,500 (awarded contract); Dowling Bros., *a* $21,017; C. H. Parritt, *a* $22,847, *b* $18,680; O'Neil & Son, *b* $16,814; W. D. Lovell, *a* $20,829, *b* $15,170; R. E. Patterson, *a* $19,100 (awarded contract); Pastoret & Lunz, *a* $15,018, b $20,708; Geo. Belden, *a* $21,895.

Melrose, Minn.—See "Power Plants, Gas and Electricity."

Comfrey, Minn.—O. W. Colley, Village Recorder, writes that it is proposed to construct water works to include an elevated tank and about 1,000 ft. of mains; probable cost of work about $5,000. Address Oscar Erickson, Village Pres.

**Bagley, Minn.*—The following are the bids opened on May 1 for the construction of water works (Engineer, Oscar Claussen, St. Paul): J. G. Robertson, $7,935; W. I. Gray & Co., $7,363; W. D. Lovell, $7,237; Pastoret & Lunz, $7,795; Crowley Electric Co., $6,891 (awarded contract); Des Moines Bridge & Iron Works, $7,280; Dwyer Plumbing & Htg. Co., $7,778.

**Whitebear Lake, Minn.*—The following are the bids opened on Apr. 24 for the construction of water works (Engineer, Oscar Claussen, St. Paul): R. E. Patterson, $11,550; W. D. Lovell, $11,587; Allan Black & Co., St. Paul $10,619 (awarded contract); Dwyer Plumbing & Htg. Co., $10,900; Des Moines Bridge & Iron Works, $11,575; W. I. Gray & Co., $11,549; Crowley Electric Co., $11,500; J. G. Robertson, $11,579.

Tupelo, Miss.—It is proposed to bore a deep well to increase the water supply. Address, W. D. Anderson, Mayor.

The U. S. Fish Hatchery at Tupelo (Mr. Hinckel, Supt.) proposes boring a deep well to supply the fish ponds.

Lincoln, Neb.—Geo. L. Campen, City Engr., writes that it is proposed to construct a reservoir at Mockett well later in the season to cost about $10,000.

Caldwell, N. J.—Jas. E. Owen, of Newark, County Engr., is reported to have been selected by the Boro. Council to investigate and report with recommendation on a pumping station for a water supply.

Perth Amboy, N. J.—Bids will be received by the Bd. Water Comrs. May 24 for furnishing and erecting at the city's pumping station at Runyon an 8,000,000-gal. pumping engine, as advertised in The Engineering Record.

**Bloomfield, N. J.*—The Town Council is reported to have granted the Montclair Water Co., which is controlled by the East Jersey Water Co., the contract to supply filtered water for a term of 20 yrs., at $65 per million gal.

Shiprock, N. M.—See "Schools."

West Orange, N. J.—Alex. Potter, of New York, N. Y., is reported to have been retained as consulting engr. to go over plans with the Water Com. for a municipal water works.

New York, N. Y.—The State Senate on May 3 passed the Tompkins bill drawn by Mayor McClellan, providing for a Commission to be appointed by the Mayor to regulate the New York City water supply system.

Bids will be received until May 31 by the Aqueduct Comrs., Stewart Bldg. (Wm. H. Ten Eyck, Pres.), for constructing a reservoir, including the building of a masonry dam across Cross River. The dam is to be built of cyclopean masonry, with a facing of concrete blocks. Engineer's estimate of the quantities is as follows: Earth excav., Class A, 65,000 cu. yds.; Class B, 3,000 cu. yds.; Class C., 120,000 cu. yds. Rock excav., Class A, 25,000 cu. yds.; Class B, 5,000 cu. yds.; Class C, 25,000 cu. yds.; Class D, 4,000 cu. yds. Refilling and embanking, Class A, 4,000 cu. yds.; Class B, 32,000 cu. yds. Timber and lumber, 1,500,000 ft. B. M.; round piles, 5,000 lin. ft.; 135,000 bbls. Portland cement; 17,500 cu. yds. concrete blocks; 6,000 cu. yds. monolithic concrete masonry; 2,000 cu. yds. granolithic finish; 132,000 cu. yds. cyclopean masonry; 10,000 sq. ft. face dressing of concrete; 4,000 cu. yds. dry rubble paving; 45 tons c. i. pipe, 25 tons special pipe castings; 40,000 lbs. miscellaneous iron castings; 7,000 lbs. miscellaneous bronze or brass castings; 15,000 lbs. steel and wrought iron work, Class A, 60,000 lbs.; Class B, 8,000 lin. ft. State highways, surfacing and miscellaneous work; 20,000 lin. ft. county highways, surfacing and miscellaneous work; 7,000 sq. yds. private roads and paths; 90,000 lin. ft. stone boundary walls, etc.

New Brighton, S. I., N. Y.—The Bd. of Estimate at New York on May 5 is reported to have decided that a commission composed of the department engineers, Nelson P. Lewis, Allen Hazen, and others, should make a report to the next meeting of the board on the water supply for Richmond Boro. Under the plan to take water from New Jersey the city is to install a distributing plant and mains at a cost of $1,500,000.

Albany, N. Y.—The State Senate on May 3 passed the Agnew State Water Commission bill, which provides for a commission to settle all differences between localities on the question of water supply.

**Cohoes, N. Y.*—A. T. Kniffin, Supt. Water Wks., writes that the Gould Mfg. Co., of Seneca Falls, has secured the contract for a power pump for $5,950, and the Platt Iron Wks., of Dayton, O., the contract for a centrifugal pump for $2,800 (bids opened May 8).

Mohawk, N. Y.—See "Power Plants, Gas and Electricity."

Buffalo, N. Y.—Bids will be received by the Dept. Pub. Wks. (Francis G. Ward, Comr.), until May 17 for a vertical turbine type pump, at Pumping Station, Bureau Water, capable of delivering not less than 25,000,000 gals, water in 24 hours into the water mains of the city of Buffalo, approximately 200 ft. head, together with a vertical shaft, three-phase induction motor of proper size to operate the pump; bids for material and labor to be submitted separately.

The following are reported to be the bids opened on Apr. 25 by the Dept. of Pub. Wks. for repairs and alterations of 6 boilers at the pumping station: Lake Erie Boiler Wks., $29,000; Farrar & Trefts, $29,618; Tashenberg Bros., $31,493; Howard Bros. Boiler Wks., $33,650. The Lake Erie Boiler Wks. also bid, instead of patching old shells, it would furnish new shells for $30,750.

**Lexington, N. C.*—M. H. Kelley, of Asheville, is reported to have secured the contract for the general construction of water works, and Alexander & Garsed and A. H. Washburn for heaters, pumps and boilers; total cost $30,242 (bids opened May 3).

Columbus, O.—The City Council has passed the ordinance appropriating $530,000 for the filtration and softening plant.

Toledo, O.—The Bd. of Pub. Service is reported to have authorized the laying of 3 miles of new 6-in. water mains in different parts of the city.

The City Council on May 8 passed an ordinance authorizing the Bd. of Pub. Service (Frank I. Consaul, Ch. Engr.) to proceed to secure bids and award contracts for the proposed filtration plant.

Cincinnati, O.—The lowest bid opened by the Water Wks. Comrs. on May 2 for laying water mains on Paddock Road was that of Thos. Maloney, 1858 Forest Ave., W. H., for $3,187, and on Reading Road, Baumer & Co., for $8,507.

Columbus, O.—Bids will be received until June 8 by the Bd. Pub. Service for furnishing material and constructing water softening and purification works of a nominal capacity of 30,000,000 gals. per day, as advertised in The Engineering Record.

Reading, O.—See "Power Plants, Gas and Electricity."

Cleveland, O.—Bids will be received May 19 by the Bd. Pub. Service (A. R. Callow, Secy.) for furnishing and delivering at the water works office, No. 354 Superior St., 90 tons more or less of pig lead.

**St. Louis, Mo.*—The following are the bids opened on May 2 by the Bd. Pub. Improv. for furnishing material and constructing a 7-ft. flow line from Baden to Chain of Rocks (bidders of St. Louis unless otherwise mentioned): (*a*) Hanley-Casey Co.; (*b*) Beuhler-Cooney; (*c*) Aug. He man; (*d*) Heine Boiler Co.; (*e*) Hill-O'Mara Constr. Co.; (*f*) T. A. Gillespie, Pittsburg, Pa.; (*g*) Carroll Contracting Co.; (*h*) Parker-Washington Co. (awarded contract); (*i*) Fruin & Colnon:

	a	*b*	*c*	*d*	*e*	*f*	*g*	**h*	*i*
1,500 cu. yds. excav. Class "A"	$1.50	$4.50	$2.00	$1.75	$0.75	$1.70	$1.25	$1.50	$1.00
2,400 cu. yds. excav. Class "B"	1.00	2.50	1.25	1.00	.75	1.70	1.00	1.00	.75
210 cu. yds. mas'ry removal	5.00	7.00	20.00	5.00	7.00	5.00	4.50	2.50	5.00
1,500 sq. ft. stone paving and rip-rap	.30	1.00	.10	.13	.15	.40	.22	.30	.30
365 cu. yds. concrete Class "A"	10.00	12.50	5.10	13.00	7.15	7.50	7.50	7.00	7.00
820 cu. yds. concrete Class "B"	8.50	12.50	6.90	11.50	7.60	8.50	7.75	8.00	8.00
1,670 cu. yds. concrete Class "C"	10.50	12.50	8.05	11.00	8.35	9.00	8.50	9.00	9.00
400 cu. ft. granite	5.00	7.00	3.16	3.00	2.65	3.00	2.95	2.25	4.00
24,000 lin. ft. reinforcing bars	.06	.08	.07	.12	.05½	.05½	.07	.06	.07
75,100 lbs. iron work	.06	.07	.05	.05	.04¼	.05	.04½	.06	.05
Screens	975.00	1000.00	800.00	800.00	700.00	935.00	700.00	1017.00	650.00
2 11x9 ft. gates	4620.00	4000.00	5133.00	4400.00	3900.00	4000.00	3900.00	4450.00	5775.00
2 7x6 ft. gates	1236.00	1200.00	1767.00	1130.00	1230.00	1560.00	1550.00	1430.00	1544.00
4 3x3 ft. gates	330.00	325.00	367.00	300.00	330.00	625.00	500.00	425.00	413.00
2 7 ft. circular gates	2288.00	1475.00	1373.00	1400.00	1475.00	1560.00	1600.00	1700.00	1987.00
1 2 ft. circular gates	360.00	300.00	320.00	260.00	255.00	400.00	400.00	325.00	360.00
1 36-in low pressure ft. gate valve	360.00	400.00	400.00	360.00	335.00	340.00	500.00	425.00	450.00
19,634 lin. ft. 7-ft. steel flow line ½-in.	21.50	22.75	24.46	24.89	22.35	25.90	25.40	21.75	26.80
1 137-ft. steel bridge superstructure	12500.00	12500.00	11370.00	12000.00	11788.00	13000.00	10700.00	9400.00	10956.00
Total	$496,185	$536,908	$549,164	$563,820	$499,239	$579,228	$562,181	$491,682	$594,851

**Items marked thus give the names of parties awarded contracts.*

Echo, Ore.—The City Council is reported to have granted C. R. Robinson a franchise to construct and operate water works.

**Ford City, Pa.*—D. O. Crouch, Boro. Secy., writes that contracts for water works improvements (bids opened May 1) have been awarded to A. V. Purnell, of Allegheny, at 45 cts. per lin. ft. for laying 12-in. pipe and 30 cts. for 10-in. pipe; for engine house, $3,290; pump pit, $3,062; filtering well, $2,050; suction line, $150, and engine and pump foundation, $100.

Allegheny, Pa.—Press reports state that plans have been prepared for an extension to the water works at Montrose; probable cost of the work is $60,000. E. J. McIlvaine, Dir. Dept. Pub. Wks.

Quarryville, Pa.—J. W. Ledoux, of Philadelphia, Ch. Engr. American Pipe Mfg. Co., writes that it is proposed to construct reservoirs at Quarryville, 500,000 gal.; Shenks Ferry, 500,000 gal., and at Atglen, 2,000,000 gal., but no bids will be called for.

Manila, P. I.—Bids will be received until May 25, by Col. C. R. Edward, Ch. Bureau of Insular Affairs, War Dept., Washington, D. C., for $1,000,000 sewer and water works construction bonds.

Bishopville, S. C.—J. C. Shann, City Clk., writes that it is proposed to construct water works at a cost of $20,000. Engineer, Chas. C. Wilson, Columbia.

Roanoke, Va.—See "Power Plants, Gas and Electricity."

Puyallup, Wash.—It is reported that plans have been prepared for water works, to cost about $33,000, and the citizens will soon be asked to vote on issuing bonds for same.

Olympia, Wash.—H. C. Hermans, of Hoquiam, is reported to have purchased the water works at Olympia and will remodel same.

Kennewick, Wash.—The Benton Water Co. is reported incorporated with a capital of $25,000 by Howard S. Amon, W. R. Amon, A. S. Smith and Bruce E. McGregor.

Tulalip, Wash.—See "Schools."

Seattle, Wash.—The lowest bid opened on Apr. 29 by the Bd. Pub. Wks. for laying water mains on Western Ave. and other streets, was submitted by Stirratt & Goetz, Washington Blk. They bid for 10,850 lin. ft. 20-in. c. i. pipe, $4.55; 14,910 lin. ft. 20-in. machine banded wood pipe, $2.50; 8,000 lbs. special castings, 8 cts.; 100 M. ft. lumber, $15; 11,000 lin. ft. piles, 15 cts., and 20 cu. yds. concrete, $10; its total bid was $101,073, which also includes gates, hydrants and other accessories. The other bidders were: Bell & Price, $111,321; F. McLellan & Co., $119,477; International Contract Co., $109,955; Puget Sound Bridge & Dredging Co., $113,849, and Pacific Coast Pipe Co., $106,490. (Bidders all of Seattle.)

Cody, Wyo.—G. W. Zorn, Ch. Engr. Big Horn Basin Development Co., writes that all bids opened on May 1 for the construction of the first 16 miles of the Shoshone River Canal, to consist of about 880,000 cu. yds. excav., mostly earth work, were too high, and no contracts were awarded.

Gibson, N. B.—Bids will be received May 15 by the Water and Fire Comrs. (T. D. Babbitt, Secy.) for $10-000 water and fire improvement bonds.

Sarnia, Ont.—John Galt, of Toronto, is stated to have reported to the Council at Sarnia that it will cost $140,000 to remove the water works to Point Edward and rebuild it. Repairs to the present plant, which provide for an extension of the main into the river, would cost $57,000.

London, Ont.—The Engr. of the Water Bd. is reported to have presented 3 plans for water extension, the question of adoption of one of which is likely to be submitted to the ratepayers shortly: Plan No. 1 proposes an independent fire system from the south branch of the river, cost $223,000. Plan No. 2 suggests a second 20-in. main to the city, from Springbank, cost $145,000, and Plan No. 3 is an independent fire system from north branch of River Thames, to cost $238,000. Added to each of these schemes is a plan to increase the present supply at Springbank by collecting springs at Kilworth, Blizzard and Hobbs, at a cost of $106,500.

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Gadsden, Ala.—Julian Kendrick, of Birmingham, is reported to be preparing an estimate of cost of constructing sewers and for paving the streets of Gadsden. The citizens will probably vote on issuing bonds for same in June.

Pine Bluff, Ark.—Bids will be received by the Comrs. of Sewer Dist. No. 8 on May 31 for furnishing material and constructing about 18,000 ft. of pipe sewer, as advertised in The Engineering Record.

**San Pedro, Cal.*—Ramish & Marsh, of Los Angeles, are stated to have secured the contract for constructing an outfall sewer in San Pedro for $18,000.

Sacramento, Cal.—J. C. Pierson, City Surveyor, writes that it is proposed to construct a trunk line sewer to be of concrete and cost $80,000. Contracts will probably be let in June.

Denver, Colo.—The Bd. of Pub. Wks. has passed a resolution asking City Council to create Highlands Special Sanitary Sewer District No. 7. It is to extend from W. 17th Ave. and Julian St. to the intersection of W. 32d St. and Yates St., and cost $69,633.

**Rockville, Conn.*—John T. McKnight, City Engr., writes that the contract for the construction of a sewage filtration plant in Rockville has been awarded to the Bunting Constr. Co., of Long Island, N. Y., for $64,750.

Wilmington, Del.—Bids are wanted until May 23 for $50,000 bonds for the use of the Bd. Dirs., Street and Sewer Dept., for the elimination of grade crossings of railroads and for the improvement of streets, avenues, lanes and alleys and for the extension of sewers; Fred C. Mammerle, City Treas.

**Jacksonville, Fla.*—J. H. Harris, of Jacksonville, has secured the contract for constructing a brick drain at $4.89 per ft. for 30-in., $3.85 for 24-in. and $3.45 for 30-in., in all about 1,720 ft. and manholes ea. $45.

Chicago, Ill.—Bids will be received May 17 by the Bd. Local Improv. (And. M. Lynch, Pres.) for constructing vitr. tile pipe sewers with manholes and catch basins in portions of 9 streets; also a brick and vitr. tile pipe sewer with manholes in a portion of Normal Ave.

Muskogee, Ind. Ter.—See "Schools."

Brazil, Ind.—The City Engr. is reported to have completed plans for a system of sanitary sewers for the South Side.

Tulsa, Ind. Ter.—The citizens are reported to have voted to issue $30,000 sanitary sewer bonds.

Sioux City, Ia.—The Morning Side Improv. Assoc. is reported to be in favor of constructing a sewer to extend to the Floyd River at a cost of about $20,000. J. M. Lewis, City Engr.

Washington, Ia.—The City Council has passed an ordinance establishing a sewer district for the entire city, and providing for the construction, reconstruction and control of sewers.

Boone, Ia.—All bids opened Apr. 19 for furnishing material and extending the sewer outlet, 2,160 ft., 24-in. pipe, have been rejected, and City Engr. K. C. Kastberg was instructed to proceed with the work.

**Coffeyville, Kan.*—McGuire & Stanton, of Leavenworth, are reported to have secured the contract for constructing a storm sewerage system (bids opened Apr. 20) for $21,966.

Hopkinsville, Ky.—Sewer franchise will be resold by City Council on May 27.

**New Orleans, La.*—The following are the totals of three of the contracts, bids for which were opened by the Water & Sewerage Bd. on Apr. 18 in connection with the construction of about 65 miles of sewers: (*a*) "Contract R," (*b*) "Contract S," (*c*) "Contract T": Black & Laird, Birmingham, Ala., *a* $189,293 (awarded contract), *b* $141,910, *c* $105,172; A. L. Patterson & Co., Macon, Ga., *a* $193,046, *b* $140,097, *c* $125,149; G. R. Turner, New Orleans, *a* $195,365, *b* $118,627, (awarded contract); Irwin Bros., New Orleans, *a* $203,412, *b* $132,041, *c* $96,942 (awarded contract); Weatherford & Cary Bros., Memphis, *a* $215,506, *b* $140,980, *c* $109,442; Suderman, Dolson & Co., Houston, Tex., *a* $230,018; McGovern Constr. Co., Trenton, N. J., *b* $185,796, *c* $108,902; J. H. McKnight, New Orleans, *c* $112,823.

Marion, Mass.—The State Bd. of Health has approved the plans of Williams & Whitman, of New York, N. Y., for sewers, 2 pumping plants and sand filters, to cost $30,000. An election to vote issuing the bonds will soon be held.

**Boston, Mass.*—C. E. Putnam, Consulting Engr., Boston, writes that the following are the bids opened May 1 for a drain for Nervine Asylum Brook: Wm. J. Barry, $8,194 (awarded contract); Rowe & Perini, $8,385; Metropolitan Contr. Co., $8,784; Souther & Shaughnessy, $9,990; Hugh Nawn Contr. Co., $10,920; T. J. O'Connell, $11,055; Gow & Palmer, $11,242; W. B. Bryne, $11,411; Healey Sewer Machine Constr. Co., $11,638; Wm. L. Dolan, $11,867; Seth Perkins, $12,238; Coleman Bros., $12,867; Franklin A. Snow, $13,939; John A. Rooney, $14,519, and John B. Graham, $14,760. The detail bid of Wm. J. Barry, the successful bidder is as follows: 1223 lin. ft. trench, $1.20; 83 cu. yd. brick, masry., $14.50; 130 cu. yds. concrete, $6.50; 124 cu. yds. concrete in arch, $6; 122 cu. yd. reinforced concrete, $6; 27 M. ft. spruce lumber, $30; 450 spruce piles, $4.50; 1,223 lin. ft. 6-in. underdrain, 30 cts.

Lowell, Mass.—The Com. on Sewers has authorized Geo. Bowers. City Engr., to prepare an estimate of cost of a small pumping plant for the sewage of the Oakland Dist.

Pipestone, Minn.—Loweth & Wolff, of St. Paul, are stated to have completed plans for the proposed sewerage system. Probable cost, $15,000. Contract for construction will probably be let about May 18.

Webb City, Mo.—Bids are wanted June 5 for constructing 1,842 lin. ft. 8 in. vitrified pipe sewers and appurtenances, as advertised in The Engineering Record.

**New Orleans, La.*—The following are the bids opened by the Sewerage & Water Bd. (Geo. G. Earl, Gen. Supt.) for "Contract Q" of the proposed sewerage system: (*a*) Black & Laird, Birmingham, Ala. (awarded contract); (*b*) A. L. Patterson & Co., Macon, Ga.; (*c*) Irwin Bros., New Orleans; (*d*) Gid. R. Turner, New Orleans; (*e*) E. G. Truehart, San Antonio, Tex.; (*f*) Weatherford & Cary Bros., Memphis, Tenn.; (*g*) Suderman, Dolson & Co., Houston, Tex.; (*h*) McGovern Const. Co., Trenton, N. J.; (*i*) J. H. McKnight, New Orleans:

	**a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
Pipe Sewers.									
800 lin. ft. 27-in., 12-14 ft. deep	$4.80	$5.10	$5.00	$6.25	$7.20	$7.00	$7.00	$8.00	$7.70
1,500 lin. ft. 24-in., 12-14 ft. deep	3.90	4.02	4.20	6.00	5.86	5.80	5.50	7.00	5.65
400 lin. ft. 24-in. (double strength), 14-16 ft. deep	4.65	4.98	5.00	7.50	7.47	7.50	6.50	7.50	7.00
600 lin. ft. 24-in (double strength), 16-18 ft. deep	5.05	5.70	5.50	9.00	8.00	8.00	7.50	9.00	7.50
400 lin. ft. 21-in., 8-10 ft. deep	2.75	2.40	3.00	3.25	3.24	3.30	4.50	3.50	3.25
1,600 lin. ft 21-in., 10-12 ft. deep	3.15	3.24	3.50	4.00	3.94	4.30	5.00	4.75	5.00
700 lin. ft. 21-in., 12-14 ft. deep	3.65	3.48	4.00	4.80	5.16	4.70	5.00	5.50	5.90
400 lin. ft. 21-in. (double strength), 14-16 ft. deep	3.90	4.68	4.70	7.00	6.38	6.50	6.00	7.00	6.50
700 lin. ft. 18-in., 10-12 ft. deep	2.90	2.22	2.60	2.75	3.50	3.80	4.00	4.00	3.25
700 lin. ft. 15-in., 10-12 ft. deep	2.20	1.89	2.30	2.10	2.77	2.30	3.25	3.75	3.00
350 lin. ft. 12-in., 6-8 ft. deep	1.50	.95	1.40	.90	1.03	1.30	1.55	1.50	1.40
350 lin. ft. 12-in., 8-10 ft. deep	1.65	1.17	1.60	1.40	1.35	1.50	1.95	1.75	1.90
300 lin. ft. 12-in., 10-12 ft. deep	1.85	1.58	1.90	1.70	1.83	1.80	2.45	2.25	2.15
100 lin. ft. 10-in., 6-8 ft. deep	1.15	.93	.70	.80	.80	1.10	1.20	1.40	1.10
1,100 lin. ft. 10-in., 8-10 ft. deep	1.25	1.10	1.25	1.20	1.10	1.35	1.55	1.50	1.30
400 lin. ft. 10-in., 10-12 ft. deep	1.40	1.50	1.40	1.65	1.48	1.60	2.15	1.75	1.60
400 lin. ft. 10-in., 12-14 ft. deep	1.70	1.81	1.60	3.00	2.22	2.35	3.00	2.50	2.25
5,500 lin. ft. 8-in., 0-6 ft. deep	.56	.59	.70	.60	.58	.70	.60	.75	.73
30,000 lin. ft. 8-in., 6-8 ft. deep	.72	.65	.80	.65	.70	.80	.75	.85	.90
11,000 lin. ft. 8-in., 8-10 ft. deep	.90	.90	.90	.95	.90	1.00	1.25	1.00	1.20
1,500 lin. ft. 8-in., 10-12 ft. deep	1.05	1.38	1.10	1.40	1.39	1.50	1.65	1.30	1.60
2,000 ft. 6-in. house connections	.40	.36	.40	.54	.35	.50	.80	.50	.65
750 ft. 6-in. stand pipe	.20	.20	.20	.20	.20	.20	.20	.20	.20
Manholes.									
10 under 6 ft. deep	45.00	48.00	35.00	35.00	45.00	45.00	40.00	40.00	55.00
44 over 6 ft. and under 8 ft. deep	50.00	54.00	45.00	43.00	50.00	50.00	45.00	45.00	63.00
50 over 8 ft. and under 10 ft. deep	60.00	60.00	50.00	52.00	55.00	60.00	50.00	50.00	70.00
21 over 10 ft. and under 12 ft. deep	75.00	78.00	70.00	65.00	65.00	75.00	55.00	55.00	83.00
18 12 ft. deep	75.00	84.00	75.00	70.00	70.00	80.00	65.00	60.00	90.00
35 flush tanks	55.00	66.00	60.00	42.00	50.00	59.00	65.00	75.00	63.00
35 5-in. flushing siphons	15.50	15.50	15.00	15.00	15.00	15.00	18.00	15.00	15.50
Concrete.									
100 cu. yds. grade A	9.00	8.00	5.00	9.50	9.00	10.00	10.00	8.00	9.50
50 cu. yds. grade B	8.50	6.00	4.75	8.30	8.00	9.00	9.00	7.00	8.40
50 cu. yds. grade C	8.00	4.00	4.75	5.50	7.00	8.00	6.00	6.00	8.40
200 cu. yds. brick work laid in Portland cement mortar	12.00	21.60	6.00	10.00	10.00	13.00	12.00	10.00	14.00
100 cu. yds. extra excav. under 16 ft. deep	1.00	1.00	1.50	1.40	1.00	1.50	1.50	5.00	1.50
20 cu. yds. extra excav. over 16 ft. deep	2.00	1.50	1.75	1.75	1.50	2.50	2.00	4.00	1.75
Pavement taken up and replaced.									
200 sq. yds. asphalt	3.50	4.50	4.00	3.25	3.25	3.50	4.00	3.50	3.50
150 sq. yds. vitrified brick	.75	3.25	2.50	2.40	2.00	2.00	2.00	1.00	2.40
1,000 sq. yds. gravel	.50	.40	.75	.80	1.00	.50	.60	.50	.60
500 sq. yds. (banquette) Schillinger	1.25	1.29	1.00	1.00	1.50	1.50	1.90	1.20	1.50
850 sq. yds. (banquette) brick	.60	.57	.60	.50	.75	.60	.80	2.25	.80
8 M. ft. foundation lumber under pipe sewers	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00	18.00
10 M. ft. sheeting and bracing left in trench	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00	13.00
100 cu. yds. cinders	2.00	3.00	2.00	1.50	2.00	2.00	2.00	2.00	1.75
50 cu. yds. oyster shells	2.25	1.00	2.50	2.40	2.25	2.00	2.25	2.00	2.10
50 cu. yds. sand	2.25	1.50	2.50	2.40	2.25	2.00	2.00	2.00	2.50
50 cu. yds. gravel	2.50	4.00	3.00	3.50	2.25	2.50	2.50	2.00	3.00
400 lin. ft. old curb removed and reset	.40	.20	.20	.25	.35	.50	.35	.25	.35
Total	$88,756	$89,843	$91,754	$97,821	$100,127	$106,826	$110,226	$114,554	$117,063

Items marked thus give the names of parties awarded contracts.

North Platte, Neb.—Bids will be received by Wm. Yost, City Clk., May 25, for the construction of main sewers, as advertised in The Engineering Record.

Morgantown, N. C.—L. A. Bristol, Clk. Supreme Court, writes that the citizens have voted to issue $25,000 bonds for the construction of a sewerage system.

Newton, N. J.—The Town Clk. writes that Williams & Whitman, of New York, N. Y., are the engineers for the proposed sewerage system to cost between $75,000 and $90,000. Only preliminary work has as yet been done.

Shiprock, N. M.—See "Schools."

Brooklyn, N. Y.—The following are the bids opened on May 3 by Martin W. Littleton, Pres. Brooklyn Boro., for furnishing material and constructing a sewer in Newkirk Ave. (bidders all of Brooklyn): John J. Creen, $13,305; J. L. Cary, $13,189; Jas. Riley, $11,532; T. J. Farrell, $14,338; Murphy Bros., $11,755; P. J. Murray, $11,620; Sigretto & Mannina, $11,684, and Donegan & Redmond, $12,134. The detail bid of Jas. Riley, the lowest bidder, is as follows: 510 lin. ft. 30-in. reinforced concrete sewer, $5.50, and for pipe sewer, 270 lin. ft. 24 in., $3; 395 lin. ft. 18-in., $2; 1,215 lin. ft. 15-in., $1.40; 1,100 lin. ft. 12-in., $1.10; 33 manholes, each $41, and 26 sewer basins, each $110.

Ballston, Spa., N. Y.—Bids will be received by the Village Trus. May 18 for constructing about 8 miles of sewers as advertised in The Engineering Record.

New Rochelle, N. Y.—Bids will be received May 22 by the Bd. Sewer Comrs. (Geo. W. Sutton, Chmn.) for constructing sewers in portions of Villas, Russell and Davis Aves., and E. Main and Huguenot Sts.

Waverly, N. Y.—Williams & Whitman, 1702 Whitehall Bldg., New York, N. Y., have been selectd to prepare plans for a sewerage and sewage disposal plant for Waverly.

East Syracuse, N. Y.—Nelson L. Lansing, Village Clk., writes that the citizens voted Apr. 29 to issue $25,000 bonds for completing the sewerage system. Engineer, W. S. Farrington, Syracuse.

Ithaca, N. Y.—The Special Sewerage Com. has appointed Williams & Whitman, Inc., 1702 Whitehall Bldg., New York, as engineers to make investigations and suggest a remedy for abating nuisance in Cascadilla Creek, resulting from overflow from sewer station.

Brooklyn, N. Y.—Bids will be received May 17 by Martin W. Littleton, Pres. Boro. Brooklyn, for furnishing materials and constructing sewers in portions of New York Ave., Glenwood Road, E. 23d and 60th Sts. Engineer's estimate: 1,930 lin. ft. 12 in. and 90 lin. ft. 15. in. pipe sewer; 144 cu. yds. concrete cradle; 20 manholes; 10 sewer basins, etc.

Trenton, N. J.—Bids will be received by the Common Council until May 16 for constructing sewers in portions of Princeton and Evans Aves.; C. C. Haven, City Engr.

**Cleveland, O.*—The Bd. of Pub. Service on May 6 awarded Aug. Wagner the contract for constructing the Euclid Ave. Sewer, bet. Fairmont and Mayfield Sts. for a total of $37,801. He bid for brick sewers as follows: 2 and 3 C., $4 per lin. ft.; 5 C., $5.50; 6 C., $6.50, and 7 C., $10.59. For brick sewer in tunnel, $18.50, $19 and $19.93 per lin. ft. and circ. brick sewer, $25 per lin. ft.; Portland cement concrete $8 and $9 per cu. yd.; 1 sanitary flow and deflection chamber, $546; 1 inverted siphon, $1,157, and 1 storm water outlet, $432. The other bidders were A. F. Helm, $55,860 and C. Burkhart, $45,129.

Leetonia, O.—An election will probably be held some time this month to vote on issuing $40,000 bonds for sewers, a pumping station and purification plant. Engineers, Williams & Whitman, Inc., New York, N. Y.

Painesville, O.—Bids will be received May 23 by the Bd. Pub. Service, for furnishing materials and constructing about 11,428 ft. of 42-in. brick or 36-in. pipe down to 8-in. pipe sewer, and appurtenances. H. P. Cumings, City Engr.

**Cincinnati, O.*—The contract for constructing sewers in Alma and adjoining streets is stated to have been awarded by the Board of Public Service on May 6 to John E. Mahoney, 719 Whittier St., for $13,020.

Springfield, O.—W. H. Sieverling, City Engr., writes that the citizens voted on May 2 against issuing bonds for sewers. Another election will be held on the question in November.

Toledo, O.—Bids will be received May 16 by the Bd. Pub. Service (Harry S. Jones, Secy.) for furnishing material and constructing main sewer, in Sewer Dist. No. 33.

Sayre, Pa.—Williams & Whitman, 1702 Whitehall Bldg., New York, N. Y., have been selected to prepare plans for a sewerage system for Sayre.

Harrisburg, Pa.—The following are the bids opened on May 2 for constructing sewers (H. Lynch, Highway Comr.): (*a*) 17th and Berryhill Sts., concrete brick and terra cotta pipe; (*b*) 18th and Holly Sts., brick and terra cotta pipe (bidders of Harrisburg, unless otherwise mentioned): United Ice & Coal Co., *a* $15,325, *b* $15,865; Fisher & Ball, *a* $15,900, *b* $16,300; Wm. H. Oppernan, *a* $16,697, *b* $17,130; Geo. B. Stucker, *a* $16,499, *b* $18,782; R. A. Malone, Lancaster, *a* $20,100, *b* $20,190.

Reading, Pa.—Local press reports state that bids will be received until May 25 by the Bd. Pub. Wks., for constructing catch basins in 18th and Cotton and 19th and Cotton Sts.; also for cleaning catch basins, setting new and resetting old curb, furnishing and delivering new curb, for sharp paving sand, gutter brick or block, cement, black sand, iron castings, cast iron scrap, sand for the disposal plant; probable cost $25,000. Elmer H. Beard, City Engr.

Darlington, S. C.—Bids are wanted June 1 for the construction of a sewerage system, as advertised in The Engineering Record.

Petersburg, Va.—The Special Com. of Common Council, appointed to investigate and report the matter of the extension of the sewer system of the city, is stated to have decided to recommend the construction of sewers in a number of streets at an estimated cost of about $30,000.

Milwaukee, Wis.—About $200,000 will be expended the coming season for building brick and pipe sewers.

Peterboro, Ont.—It is stated that bids will be received until May 19 by Frank Adams, Chmn. Bd. Wks., for constructing a main sewer and sedimentation tank in Ward No. 5. Sewers comprise 270 ft. 14-in. iron submerged outlet pipe, 1,400 ft. 18-in. and 1,300 ft. 15-in. tile pipe. Willis Chipman, 103 Bay St., Toronto, Ont., is the consulting engr.

**Galt, Ont.*—T. McLaughlin, of Ottawa, is reported to have secured the contract for about 7 miles of sewers and 5 miles of storm drains (bids opened May 1).

Havana, Cuba.—President Palma is reported to have vetoed the bill appropriating $1,500,000 to assist in the sanitary work of all the municipalities.

Manila, P. I.—See "Water."

BRIDGES.

Birmingham, Ala.—Bids will be received until May 16 by the Bd. Revenue, of Jefferson County (John T. Reed, Pres.), for constructing several steel bridges.

Hartford, Conn.—Bridge bonds amounting to $1,000,000 are reported sold.

Denver, Colo.—All bids opened on Apr. 26 by the Bd. of Pub. Wks., for bridge across Platte River, at W. Colfax Ave., were rejected on May 3 and new bids will be received on a narrower bridge to have two 8-ft. sidewalks and a 34-ft. roadway. The bids received on Apr. 26 were as follows: The Hinchman Fireproofing Co., Denver, $21,600; the Denver & Pueblo Constr. Co., Denver, $29,781; Marsh Bridge Co., Des Moines, Ia., $29,800; Chas. W. Comstock, Denver, three designs, $27,760, $35,000 and $40,000.

Washington, D. C.—W. J. Douglas, Engr. of Bridges, D. C., writes that the following are the bids opened on May 1 by the Comrs., D. C., for constructing a 7-span steel bridge across the Eastern branch of Potomac River at 11th St. (*a*) For bridge complete, except pavt. bet. exterior rails of tracks and for a distance of 2 ft. from exterior rails on each side and except. entire floor system supporting pavement: (*b*) for pavt. between exterior rails of tracks and for a distance of 2 ft. from exterior rails on each side and entire floor system, supporting pavt. excepting yokes and saddles; (*c*) masonry work complete, including the furnishing and erecting of steel, iron, wood and glass work as part of sub-structure; (*d*) for superstructure complete, except pavt., etc., according to (*a*); (*e*) for pavt. between the exterior rails, etc., according to (*b*): Penn Bridge Co., Beaver Falls, Pa., *a* $319,160, *b* $20,300, *d* $141,400, *e* $20,300; McMullen & McDermott, Potomac Flats, Washington, *a* $338,200, *b* $18,250, *c* $178,700, *d* $159,500, *e* $18,250; Geo. W. Catt, Park Row Bldg., N. Y. City, *a* $342,000. *b* $21,000; McClintic-Marshall Constr. Co., Pottstown, Pa., *d* $160,000, *e* $18,050; King Bridge Co., Cleveland, O., *d* $169,900, *e* $21,000; Pennsylvania Steel Co., Steelton, Pa., *a* $353,000, *b* $25,000, *c* $180,000, *d* $173,300, *e* $25,000. The latter company submitted an alternate bid of $348,000 for bridge complete, with $25,000 for paving bet. the tracks. The R. R. Co. is to pay for paving work bet. the rails.

**Peru, Ind.*—A. W. Smith, County Surveyor, writes that the National Concrete Co., of Indianapolis, has secured the contract for constructing a reinforced concrete arch across Wabash River (bids opened May 3) for $36,900. The other bids received on this class of bridge were as follows: Fred Hoffman, Crawfordsville, $37,400; Block Bridge & Culvert Co., $39,800, and the Collins Bridge Co., $39,237. Figures were also submitted on a steel bridge as follows: Walker Bros., Benton Harbor, Mich., $21,590; Lafayette Eng. Co., Lafayette, $25,900; Anderson Bridge & Scraper Co., Anderson, $22,572; Canton Bridge Co., Canton, O., $24,989; Wynkoop & McGormley, Toledo, O., $28,269; Pan-American Bridge Co., New Castle, $21,998; R. R. Moorman & Co., Lafayette, $24,795, and the Joliet Bridge & Iron Co., Joliet, Ill., $24,886.

**Wabash, Ind.*—The contract for constructing a bridge 275 ft. long over Eel River at Stockdale is stated to have been awarded to John Ross, of Frankfort, for about $12,000.

Baltimore, Md.—The construction of a concrete bridge over Stonyrun and the railroad tracks connecting Wyman and Druid Hill Parks is reported under consideration. Probable cost, $20,000.

Jackson, Miss.—The Superv. of Hinds County have authorized the construction of a bridge over Chapman Creek, near Jackson. Address Saml. Livingston, Clk. Bd. Superv.

Upper Marlboro, Md.—See "Railroads."

Lenox, Mass.—It is stated that bids are wanted May 20 by the Bd. Selectmen, for constructing superstructure of a riveted truss bridge over Housatonic River. Henry L. Norton, engr., 33 Lyman St., Springfield.

Constantine, Mich.—The following bids are stated to have been opened Apr. 25 for constructing a bridge over St. Joseph River at Constantine: Houston & Cleveland steel girder bridge, $18,500, single span, $17,372; Champion Bridge Co., 2-span high truss, $16,742; Utica Bridge Co., 2-span, $15,000; Jenks & Diesser, 3-span, $15,000; Groton Bridge Co., 2-span, $14,875; Massillon Bridge Co., 2-span, $16,000; H. V. Snyde & Son, concrete and steel rods, 3-span, $12,485, and Elkhart Bridge Co., low truss, 3-span, $13,477 (awarded contract).

Mallory, Minn.—Bids will be received June 1 by the Bd. Co. Comrs., at Crookston, for 2 approaches to the bridge over Red Lake at Mallory, the approach at the south end to be 105 ft. and the one at the north end 55 ft. long; Nels. A. Hoffard, Co. Aud.

French Lake, Minn.—It is reported that bids will be received until May 23 by the Bd. Co. Comrs., Ruffal, Minn. (W. H. Marvin, Chmn.), for constructing a steel bridge over Crow River in French Lake.

Schuyler, Neb.—It is reported that bids will be received by the Bd. Co. Comrs., until May 22, for constructing county bridges for 1 year; J. P. Maple, Co. Clk.

Middletown, N. Y.—Bids are wanted May 15 for tearing out west abutment of Pellet Island Bridge and rebuilding of a new stone pier on a pile foundation, as advertised in The Engineering Record.

Dayton, O.—Bids will be received June 6 by Bd. Pub. Service for constructing a concrete steel bridge across Great Miami River at Washington St., as advertised in The Engineering Record.

Toledo, O.—It is stated that bids will be received by the Co. Comrs. until May 23 for constructing a stone or concrete culvert on Stone Road No. 34. D. T. Davies, Jr., Co. Aud.

Lima, O.—Bids will be received June 1 by the Bd. Co. Comrs., for constructing a 1-span, 104-ft. long, high-truss iron bridge over Riley Creek in Richland Township, with a roadway 16 ft. wide. C. S. Craig, Co. Engr.

Portland, Ore.—See "Railroads."

West Newton, Pa.—Press reports state that bids are wanted until May 25 for constructing a 3-span steel bridge over the Youghiogheny River, each span to be 60 ft. long, with a roadway 24 ft. wide and a 6-ft. sidewalk, the driveway and sidewalk to be laid with hard brick and concrete; it will have 2 stone abutments and 2 stone piers. Probable cost, $75,000.

Harrisburg, Pa.—The Bd. of Viewers appointed to inquire into the matter of constructing a state bridge over the Kiskimineats River, between Westmoreland and Armstrong Counties, is stated to have decided in favor of constructing a bridge at a probable cost of $60,000.

Britton, S. D.—Bids will be received May 19 by the Bd. Co. Comrs. for furnishing materials and constructing 4 steel bridges. For further particulars address M. S. Woodard, Co. Aud.

**St. Johnsbury, Vt.*—The following are the bids opened May 2 by the Bd. of Selectmen, for a steel highway bridge, 155 ft. long, 24 ft. wide, with one 6-ft. walk: Berlin Constr. Co., Berlin, Conn., $12,000; the United Constr. Co., Albany, N. Y., $12,075 (awarded contract); Groton Bridge Co., Groton, N. Y., $12,385; Canton Bridge Co., Canton, O., $12,783; Springfield Constr. Co., Springfield, Mass., $12,800, and Boston Bridge Wks., Boston, Mass., $13,120.

Milwaukee, Wis.—The City Council passed a resolution instructing the Chicago, Milwaukee & St. Paul R. R. Co. (D. J. Whittemore, Ch. Engr., Chicago, Ill.) to remove present viaduct and replace the structure.

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Gadsden, Ala.—See "Sewerage and Sewage Disposal."

Pine Bluff, Ark.—See "Business Buildings."

Little Rock, Ark.—It is stated that E. A. Kingsley, City Engr., will receive bids until May 22 for paving a portion of E. 9th St., with vitrified brick on a 5-in. concrete base.

San Francisco, Cal.—Bids will be received May 31 by Col. Wm. S. Patten, Ch. Q. M., U. S. A., San Francisco, for furnishing labor and materials required in grading roads and gutters, building drains, etc., at Ft. Barry, Point Bonita, Cal.

Waterbury, Conn.—It is reported that bids will be received until June 6 by the Bd. Pub. Wks. for paving portions of N. Main, Benedict and Scoville Sts. Engineer's estimate, 3,750 sq. yds. vitr. brick. R. A. Cairns, City Engr.

Wilmington, Del.—See "Sewers."

Washington, D. C.—Bids will be received May 31 by Capt. A. W. Butt, Depot Q. M., U. S. A., Washington, for paving and curbing road on U. S. Reservation, at Virginia approach to Washington Aqueduct Bridge.

Bloomington, Ill.—It is proposed to pave Mulberry St., from Madison to Howard St. with asphalt, 9,000 sq. yds. Elmer Folsom, City Engr.

Chicago, Ill.—Bids will be received May 17 by the Bd. Local Improv. (And. M. Lynch, Pres.) for grading, curbing and paving portions of numerous streets with asphalt, repressed vitrified brick, granite blocks and limestone.

**Versailles, Ind.*—Nicholas Volz, Co. Aud., writes that the contract for constructing 2¼ miles of macadam roads (bids opened May 2) has been awarded to Harry Dobson, of Napoleon, for $6,480.

**Bedford, Ind.*—Walter G. Owens, Co. Aud., writes that the contract for constructing gravel or macadamized roads in Marshall Township (bids opened May 2) has been awarded to Nerman & Kenser, of Heltonville, for $16,975.

Indianapolis, Ind.—Bids will be received June 6 by the Bd. Co. Comrs., for constructing gravel and macadamized roads in Grant, Cass and Stafford Townships; Wm. H. Deckard, Co. Aud.

Ft. Leavenworth, Kan.—Bids will be received May 24, by Capt. J. E. Normoyle, Constr. Q. M., U. S. A., Ft. Leavenworth, for constructing granolithic walks, etc., here.

Louisville, Ky.—It is stated that bids will be received by the Bd. Pub. Wks., until May 17 for 4,100 ft. asphalt paving on Frankfort Ave.

New Orleans, La.—Bids will be received by Chas. R. Kennedy, Comptroller, June 19, for the construction of an asphalt plant for the repair of asphalt streets, as advertised in The Engineering Record.

It is stated that a portion of Camp St. will be resurfaced with asphalt.

Donaldsville, La.—See "Water."

Portland, Me.—See "Water."

West Boylston, Mass.—Bids will be received by the Metropolitan Water & Sewerage Bd. at Boston, May 19, for building about 2¾ miles of macadam road, chiefly in West Boylston, as advertised in The Engineering Record.

Red Jacket, Mich.—Bids will be received until May 23 by the Village Council for the paving of streets, the construction of concrete walks and combined curb and gutters and certain other street improvements to be furnished and done in the village, as advertised in The Engineering Record.

**Grand Rapids, Mich.*—The Bd. of Pub. Wks. is stated to have awarded on Apr. 21 the following contracts: A portion of Fuller St. to Kloote & Vanderveen, for $6,310; a portion of Sinclair St. to Jas. McDermott & Son, for $4,844, and a portion of B St. to Gilner & Schneider, for $2,400.

**St. Charles, Mo.*—Carr Edwards, City Engr., writes that the Hill-Gaynord Constr. Co., of East St. Louis,

**Items marked thus give the names of parties awarded contracts.*

Ill., has secured the contract for paving (bids opened May 4) as follows: 9,331 sq. yds. vitr. brick on 6-in concrete foundation, $1.63; 191 sq. yds. vitr. brick crosswalk, $1.63 and 4,050 lin. ft. Bedford limestone curb., 6x 18 in., 58 cts.

Newark, N. J.—The lowest bid opened on May 2 by the Essex County Park Comn., for constructing roadway, drainage, etc., in connection with the bridge across Branch Brook Park at Bloomfield Ave., is stated to have been submitted by the Essex County Constr. Co., for $5,553.

The Bd. of Pub. Wks. is stated to have under consideration the paving of numerous streets, including Summit, Niagara, Bleecker Sts., at a probable cost of about $400,000.

Flemington, N. J.—Bids will be received by the Bd. Chosen Freeholders, June 7, for macadamizing the Old York Road, bet. Lambertville and West Amwell Township, and extending to Ringoes, a distance of 5.55 miles, as advertised in The Engineering Record.

**Trenton, N. J.*—Frank J. Eppele, Co. Engr., writes that the following are the bids opened on May 2 by the Bd. of Chosen Freeholders for macadam paving: (*a*) Olden Ave., 19,222 sq. yds., (*b*) Newtown and Allentown Road, 26,237 sq. yds., (*c*) Groveville Road, 9,105 sq. yds., (*d*) Brunswick Pike, 38,208 sq. yds., (*e*) Washington Crossing Road, 23,193 sq. yds., (*f*) Grovers Mill Road, 15,623 sq. yds., (*g*) Whiteheads Mill Road, 8,244 sq. yds. (bidders of Trenton, unless otherwise mentioned): John H. Hurley, *a* $20,604, *c* $10,351, *d* $32,878, *f* $14,677, *g* $7,368; Delaware River Quarry & Constr. Co., Lambertville, *a* $17,593, *d* $29,672, *f* $13,971, *g* $6,731; McGovern Contr. Co., *a* $17,612, *b* $23,653, *c* $9,598, *d* $34,209, *e* $20,260, *f* $14,365, *g* $6,214; Richard Newton, *a* $16,699, *b* $25,059, *c* $8,694, *d* $28,610 (awarded contract), *e* $21,781, *f* $13,724 (awarded contract), *g* $5,907 (awarded contract); C. B. Walton Co., *a* $16,651 (awarded contract), *b* $23,494 (awarded contract), *c* $8,870, *d* $35,296, *e* $19,563 (awarded contract), *f* $15,146, *g* $6,626: B. M. & J. F. Shanley Co., Jersey City, *b* $24,700, *c* $8,008 (awarded contract), *e* $23,000; Edw. Dilatush, Robbinsville, *b* $26,263; H. N. Scott & Co., Cranbury, *f* $14,774.

New York, N. Y.—Bids will be received May 16 by Louis T. Haffen, Pres. Boro. Bronx, for regulating, grading, curbing and flagging a portion of W. 259th St. Engineer's estimate: 3,000 cu. yds. earth excav., 8,700 cu. yds. rock excav., 28,000 cu. yds. filling, 4,125 lin. ft. new curb., furnished and set, 15,500 sq. ft. new flag. furnished and laid, 3,600 sq. ft. new bridgestone for crosswalks, furnished and laid, etc.

**Brooklyn, N. Y.*—The following are the bids opened May 3 by Martin W. Littleton for paving (bidders of Brooklyn, unless otherwise mentioned):

*Tillary St. with granite on a concrete foundation: Hickey, McFarland Co., $21,501; Norton & Gorman, $21,555; James Quinn, Sr., N. Y. City, $22,963; Brooklyn Alcatraz Co., $21,586; Cunningham & Kearns, $21,744; Chapman & Ryan, $22,761, and George & Farrell, 576 Douglass St., $21,476 (awarded contract). The detail bid of the successful bidder is as follows: 5,620 sq. yds. granite block pavt., with tar and gravel joints, $2.39; 1,140 cu. yds. concrete, $3.99; 3,750 lin. ft. new curb., 78 cts.; 400 lin. ft. old curb. reset, 35 cts.; 620 sq. ft. new granite bridgestones, 59 cts.

*Asphalt pavement on a concrete foundation (*a*) Monroe St., (*b*) Van Buren St.; Cranford Paving Co., 52 9th St., *a* $16,336 (awarded contract), *b* $12,960 (awarded contract), bidding 80 cts. per sq. yd. for paving and $3.85 per cu. yd. for concrete on both streets. Uvalde Asphalt Paving Co., *a* $17,015, *b* $13,511. Barber Asphalt Paving Co., *a* $17,186, *b* $13,642.

*Asphalt block paving on concrete foundation (*a*) 18th St., (*b*) 23d St.: Kelly Asphalt Blk Co., Brooklyn, *a* $17,282, *b* $16,472; Interstate Pav. Co., 44 Court St., *a* $17,171 (awarded contract), *b* $16,367 (awarded contract) Cranford Co., *a* $18,915, *b* $17,826; Hastings Pavt. Co., *a* $17,330, *b* $16,519; Barber Asphalt Paving Co., N. Y. City, *a* $17,255, *b* $16,580; Continental Paving Co., N. Y. City, *a* $18,595, *b* $17,722.

Bids will be received May 24 by Martin W. Littleton, Pres. Boro. Brooklyn, for grading, curbing and paving, etc., portions of numerous streets. Engineer's estimate, 7,364 sq. yds. asphalt pavt.; 5,620 lin. ft. new curb., 4,623 lin. ft. new curb., to be set in concrete; 54,345 sq. ft. cement concrete sidewalks, 10,224 cu. yds. earth excav., etc.

New York State.—The Governor is reported to have signed the following bills: Authorizing Greenburg to issue $225,000 bonds for highway improvements; also authorizing Mt. Vernon to issue $60,000 bonds for highway improvements.

Troy, N. Y.—The Common Council is stated to have decided to pave with granite blocks a portion of 7th Ave.

**Utica, N. Y.*—The Barber Asphalt Paving Co., 131 Broad St., is stated to have received the contract for paving with asphalt portions of 15 streets, for about $83,000.

Binghamton, N. Y.—Bids will be received until May 22 by D. C. Herrick, City Clk., for paving with vitrified brick about 8,227 sq. yds. on Exchange St., 6,000 sq. yds. on Court St., and 2,742 sq. yds. on Susquehanna St.

Rensselaer, N. Y.—Bids will be received until May 16 by John G. Salt, City Clk., for grading and paving on a portion of Catharine St., with vitrified brick or block with granite block, and on a portion of Bway. with either vitrified brick or block or with block or sheet asphalt.

Amsterdam, N. Y.—It is stated that bids will be received until June 6 for paving with fire-clay brick block about 1,200 sq. yds. on Chuctonunda St. Estimated cost, $3,000. F. E. Crane, City Engr.

Buffalo, N. Y.—Bids will be received May 19 by the Dept. Pub. Wks. (Francis G. Ward, Comr.) for repairing portions of Washington, Fox and Herman Sts.; also constructing concrete sidewalks and approaches, from the curb to the street line, from the date of contract to June 30, 1906.

Dallas, N. C.—Bonds amounting to $300,000 are reported sold for improving roads in Gaston County.

**Cincinnati, O.*—The contract for improving a portion of Observatory Ave. (bids opened May 6), is stated to have been awarded to the Kirchner Constr. Co., 8th and Plum Sts., for $46,153.

Bids will be received June 5 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for improving a portion of Poplar St. by grading, curbing and paving with asphalt; also same date for improving a portion of Pike St., by grading, curbing and paving with bitulithic.

Massillon, O.—Bids will be received May 31 by the Finance Com. (Tobias Schoott, Chmn.) for $55,000 paving bonds.

Bucyrus, O.—Bids will be received June 5 by W. H. Iams, City Aud., for $12,000 Sandusky Ave. improvement bonds.

Findlay, O.—Bids will be received June 1 by the Bd. Co. Comrs. (A. J. Overholt, Chmn.) for constructing 5 miles of stone pike in Orange Township.

Painesville, O.—Bids will be received by the Bd. Pub. Service, until May 23, for constructing about 2,177 sq. yds. pavt., and 1,226 ft. stone curb. H. P. Cummings, City Engr.

Sandusky, O.—It is stated that bids will be received May 16 by the Bd. Pub. Service (Bernard J. McGory, Clk.) for paving on a portion of Railroad Ave. with brick, the work to include 4,250 sq. yds. paving, 1,847 lin. ft. new curb and 12,944 sq. ft. sidewalks.

Madisonville, O.—Bids are wanted until May 23 for furnishing materials for repairing and resurfacing improved streets. Estimate quantities: 2,579 cu. yds. stone; 750 cu. yds. fine crushed stone, or screenings and 36,000 sq. yds. sprinkling and rolling; J. A. Conant, Village Clk.

**Cleveland, O.*—The Cleveland Trinidad Paving Co., of Cleveland, is stated to have received the contract for paving with brick a portion of Woodland Hills Ave. for $23,000.

**Erie, Pa.*—The contract for paving with brick on 13th St. is stated to have been awarded to John McCormick & Son, 645 W. 10th St., at $1.44 per sq. yd.

All bids received for paving a portion of 26th St. are stated to have been rejected. According to reports new bids will be received.

**Pittsburg, Pa.*—The Blake Asphalt Maintenance Co., of Cincinnati, O., is stated to have received the contract for repaving with asphalt on portions of several streets for about $33,000. Bids opened by the Dept. Pub. Wks. on Apr. 18.

Butler, Pa.—Bids will be received May 16 by the Town Council (H. E. Coulter, Secy.) for paving portions of Franklin, E. Penn and McKean Sts.

Meadville, Pa.—It is probable that Chestnut St. from Market to Diamond St. will be paved at a cost of $10,000. W. A. Doane, City Engr.

Knoxville, Tenn.—The property owners of W. Church Ave. have petitioned Council for asphalt paving. T. J. Moreland, City Engr.

**Enid, Okla Ter.*—The Cleveland Trinidad Asphalt Co. has secured the contract for paving E. Bway. with asphalt, about 14,000 sq. yds.

The paving of W. Bway. is reported to be in contemplation.

Seattle, Wash.—The following bids are stated to have been opened Apr. 29 by the Dept. of Pub. Wks. for paving in Kenton Hill: F. McLellan & Co., $396,500; Barber Asphalt Paving Co., of Seattle, $379,154; Stirrat & Goetz, Epler Blk., $379,852, and Warren Constr. Co., $409,459.

Tacoma, Wash.—All bids opened on Apr. 25 for paving K St. with asphalt are stated to have been rejected, and according to reports new bids will be received.

It is stated that bids will be received until June 1 for paving with asphalt on Jefferson St. Probable cost, $16,000. Frank L. Davis, City Engr.

Seattle, Wash.—The following are the bids opened Apr. 29 by the Bd. of Pub. Wks. for paving 18th and other streets with asphalt: (*a*) F. McLellan & Co., Burke Bldg.; (*b*) Barber Asphalt Pav. Co., Bailey Bldg. (bid does not include removing inlets); (*c*) Stirrat & Goetz, Washington Bldg.; (*d*) Warren Constr. Co.:

	a	*b*	*c*	*d*
Fixed estimate, $7,000	$7000.00	$7000.00	$7000.00	$7000.00
Clearing and grubbing (lump sum)	4000.00	2000.00	2300.00	3000.00
50,000 cu. yds. sub-grading	.35	.30	.50	.40
330 lin. ft. 8-in. pipe sewer	1.10	.80	1.00	1.25
53 catch basins, single inlets	50.00	50.00	60.00	65.00
7,550 lin. ft. curved granite curb	1.50	1.40	1.50	1.75
89,800 lin. ft. concrete curb	.38	.32	.36	.37
10 M. ft. new lumber	16.00	15.00	10.00	15.00
1,100 sq. yds. concrete	1.25	1.00	1.20	1.25
50 lin. ft. 6-in. c. i. pipe	1.20	1.00	1.00	1.25
129,010 sq. yds. asphalt pavement, 4-in base	2.00	2.00	1.87	2.00
40,900 sq. yds. concrete base for ea. extra in.	.07	.13	.15	.20
16,500 sq. yds. brick gutters, 4-in. base	2.40	2.40	2.40	2.75
900 lin. ft. wooden stop	.45	.45	.50	.50
54 catch basins rebuilt	30.00	15.00	20.00	50.00
7 catch basins without inlets	40.00	35.00	45.00	40.00
7 single inlets	15.00	16.00	20.00	20.00
230 inlets to be moved	10.00	....	5.00	7.00
220 catch basins and manhole covers adjusted	2.00	2.00	2.00	1.00
2,300 sq. yds. concrete alley crossings	1.35	1.25	1.35	1.75
5 M. ft. lumber alley crossings	16.00	15.00	10.00	16.00
105 monument cases	10.00	7.00	10.00	10.00
700 M. ft. old lumber to be used	10.00	3.00	1.50	6.00
13 fire hydrants	75.00	65.00	80.00	90.00
	$396,450	$379,154	$379,852	$409,458

Oconomowoc, Wis.—It is reported that bids will be received until May 17 by the Merchant Co. (Edw. S. Thompson, Pres.), for about 4,400 lin. ft. cement sidewalks, and about 8,500 lin. ft. cement curb.

Racine, Wis.—The Council is stated to have decided to issue $100,000 street improvement bonds.

Montreal, Que.—Bids will be received until May 18 by L. O. David, City Clk., for furnishing and delivering in corporation yard, De Lorimer Ave., a 5-ton steam asphalt roller.

Arnprior, Ont.—It is stated that bids will be received until May 26 for constructing about 120,000 ft. of concrete walks, beside curbs and crossings. Geo. E. Neilson, Clk.

**Parry Sound, Ont.*—E. E. Armstrong, Town Clk., writes that the contract for laying about 55,000 sq. ft. of granolithic sidewalks (bids opened Apr. 23) has been awarded to S. B. Spragge, of Wiarton, at $9.95 per sq. ft.

Dunnville, Ont.—It is stated that bids are wanted May 17 for constructing about 20,000 sq. ft. of cement concrete walks. J. W. Holmes, Clk.

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Tuscumbia, Ala.—The Mussel Shoal Electric Co. is reported organized, with a capital of $10,000, for the purpose of supplying electric light and power, heat, etc., from Mussel Shoal. Incorporators: Thos. H. Jackson, Memphis, Tenn.; Jas. Jackson, of Tuscumbia, and others.

Gadsden, Ala.—The City Council is stated to have on May 5 granted to C. B. Foreman and John B. Hammond a franchise for a gas plant.

Yellville, Ark.—Isaac Emery is reported to have petitioned Council for a franchise for an electric light plant.

Wilmington, Del.—The Wilmington Electric Light & Power Co. is reported incorporated, with a capital of $1,000,000, and has petitioned the Street and Sewer Dept. for a franchise. Wm. F. and Chas. C. Kurtz are among the incorporators.

Los Angeles, Cal.—Harry F. Stafford, City Engr., writes that plans are being prepared for a distribution system for lighting portions of Spring and Main Sts.

Washington, D. C.—Bids will be received May 31 by the Bureau of Supplies and Accounts, Navy Dept., Washington, for furnishing at the navy yards, etc., Portsmouth, N. H.; Boston, Mass.; Newport, R. I.; New York, N. Y.; League Island, Pa.; Washington, D. C., and Norfolk, Va., a quantity of naval supplies, as follows: Electric wire, battery cells, motor, etc.; Portland cement, broken stone, mosaic tiling, steel bars and angles; copper and brass pipe, pumps, pipe fittings, steel conduit, steel billets and plates; pressure gauges, charging valves, plain and corrugated galvanized sheet steel, etc.; also May 23, for furnishing the navy yard, Pensacola, Fla., and naval station, Key West, Fla.; New Orleans, La., and San Juan, P. R., a quantity of naval supplies, as follows: Supplies for electric battery, Portland cement, gravel, brick, copper, brass, corrugated sheet steel, sheet copper, bar, pig and scrap iron, steel plates, pipe fittings, brass and copper pipe; magnesia boiler, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Bids will be received until May 22 by the Comrs. D. C. for lighting the streets, avenues, alleys and roads in the Dist., as advertised in The Engineering Record.

Bids will be received by the Comrs. D. C. until May 20 for electrical work at No. 18 engine house at Virginia Ave., S. E., as advertised in The Engineering Record.

Pelham, Ga.—The City Council is reported to have granted W. H. Maury a franchise for an electric light plant.

Covington, Ga.—The City Council is reported to have approved the plans of the White Shoals Power Co. for lighting the city from its proposed plant on Alcovey River, 10 miles southeast of city.

Austell, Ga.—C. J. Shelverton, Mayor, writes that it is proposed to construct an electric light plant to cost from $2,500 to $3,000. No engineer selected as yet.

Ocilla, Ga.—The City Council is stated to have decided to call an election to vote on issuing $20,000 bonds for water works and an electric light plant.

Georgetown, Ill.—P. Fulmer, Engr. Georgetown Electric Co., writes that about $15,000 will be expended in improvements.

Kewanna, Ind.—The Kewanna Light Co. is reported incorporated with a capital of $15,000. Dr. A. Armstrong, Pres.

Flora, Ind.—Dr. Ross, of Wabash, is reported interested in the construction of an electric light plant at Flora.

**Lafayette, Ind.*—The Lane & Pike Co., of Lafayette, is stated to have secured the contract for reconstructing power house and heating plant at State Soldiers' Home (bids opened May 2) for $35,060.

Wynnewood, Ind. Ter.—The Council is reported to have granted S. E. Hutchins, of Whitehall, Wis., a franchise for an electric light plant.

Sioux City, Ia.—It is reported that the Sioux City Gas & Electric Co. will extend its gas mains to Leeds at a cost of $25,000.

Decorah, Ia.—H. J. Hedges is reported to have secured a franchise for a gas plant.

Oxford, Ia.—The Council is reported to be considering the construction of a gas plant.

Topeka, Kan.—The question of combining the city electric light plant with the Harrison St. pumping plant of the water works is reported under consideration.

Paducah, Ky.—David G. Wright, of St. Louis, Mo., and other St. Louis and New York capitalists, are reported interested in the construction of an electric light and power plant here, to cost from $300,000 to $500,000.

Shreveport, La.—J. F. McCulloch, of St. Louis, Mo., estimates the cost of constructing a municipal electric light plant at $171,000. This provides for a plant with a capacity of 10,000 incandescent lights of 16 c.p. each and 200 street arcs of 2,000 cp. each.

***Items marked thus give the names of parties awarded contracts.*

Lake Charles, La.—The City Council is reported to have decided to call an election to vote on issuing $60,000 bonds to build a municipal electric light plant or purchase plant of the local electric light company.

Portland, Me.—G. M. Gest, 277 B'way, New York, N. Y., and with offices at Cincinnati, O., has secured the contract for constructing a complete underground conduit system for the Consolidated Electric Light Co. of Maine, at Portland.

Fall River, Mass.—The stockholders of the Fall River Electric Light Co. are stated to have voted May 7 to increase the capital stock from $350,000 to $600,000, the increase to be used for the construction of a new generating plant on the company's wharf property, and also to extend its system of distribution.

Rose City, Mich.—The Rose City Mfg. Co. is reported to be figuring on installing a city electric light plant.

Farmington, Minn.—The Farmington Electric & Gas Light Co. is reported to have petitioned for a franchise for a gas plant.

Melrose, Minn.—F. J. Weisser, City Clk., writes that Oscar Claussen, of St. Paul, will prepare plans for the proposed water works and electric light plant. Probable cost of work, $30,000.

**Meridian, Miss.*—The Mayor and Boards of Aldermen and Councilmen on May 5 are stated to have granted L. W. Ullman a franchise for the operation of an electric light and power plant for a period of 45 yrs.; also the contract for lighting the city for 5 yrs. at $69.50 each for 200 arc lights.

St. Louis, Mo.—The Laclede Gas Light Co. is reported to have decided to expend about $500,000 in improvements.

Dr. Heine Marks has petitioned Council for a 50-yr. franchise to furnish natural gas. It is proposed to lay mains from Southern Kansas to the city of St. Louis.

Breckenridge, Mo.—The citizens are reported to have voted to issue $10,000 bonds for the construction of an electric light plant.

Lincoln, Neb.—It is reported that bids will be received until May 19 by Thos. H. Pratt, City Clk., for furnishing pipe, fittings, valves, etc., necessary to install a complete system of piping in the municipal electric lighting and power plant.

Brooklyn, N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., New York City, until May 22, for installing electric equipment in School No. 147, Boro. Brooklyn.

Long Island City, L. I., N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., New York City, until May 22, for installing electric equipment in School No. 4, Boro. Queens.

Jamaica, L. I., N. Y.—The Interinsular Heat, Light & Power Co., of New York City, is reported incorporated, with a capital of $500,000 to operate in the boroughs of Richmond and Queens, and in various towns and villages in Nassau and Suffolk Counties. Directors, John Eckhardt, of New York; E. D. McLean, of Yonkers, and Edw. A. Kracke, of Brooklyn.

Ilion, N. Y.—The Governor has signed the bill legalizing issue of bonds for the repair of the electric light plant.

Mohawk, N. Y.—The Governor has signed the bill legalizing the issue of $30,000 bonds for water, lighting and other improvements.

Niagara Falls, N. Y.—The Niagara power bill was defeated May 3 in the Assembly Rules Committee.

Ossining, N. Y.—The Northern Westchester Lighting C., of Ossining, has been incorporated with a capital of $1,000,000, to supply gas and electricity for light, heat and power purposes. Directors, Wm. J. Bagnell and Jas. H. Hagerty, of Brooklyn, Alex. Keogh, of New Rochelle, and others.

Hermon, N. Y.—Cullimore & Killelea, of Hermon, are interested in the construction of an electric light plant. Engineer, Geo. Gould, Ogdensburg.

Albany, N. Y.—The Hanover Light & Power Co., of Albany, is reported incorporated with a capital of $2,000,000 to furnish gas and electricity for light, heat and power in Albany, Buffalo, Utica, Syracuse, Rochester, Troy and other cities in New York State. Incorporators, Edmund G. Du Mazuel and Fred. K. Morris, of New York, and Wm. Brower and Maurice S. Decker, of East Orange, N. J., and others.

Ft. Ontario, N. Y.—The following are reported to be the bids opened on May 2 by Capt. W. M. Coulling, Q. M., U. S. A., at Oswego, for furnishing material and installing interior and exterior lighting at Ft. Ontario: Jos. W. Roman & Co., New York, $6,505; Malcolm W. Hill Co., New York, $7,500; John W. Schaffer, Oswego, $10,719, and the B. & C. Electric Constr. Co., Utica, $11,998.

Fayetteville, N. C.—The citizens are stated to have voted May 1 to issue $30,000 bonds for enlarging the electric light plant.

Waynesville, N. C.—The citizens are reported to have voted May 1 to install a system of electric lighting.

Kings Mountain, N. C.—The citizens are reported to have voted May 2 to issue $15,000 bonds for the construction of an electric light plant.

Reading, O.—J. R. Vedder, City Clk., writes that contracts will probably be let in June for improvements to the water and light plant to cost about $27,000. B. A. Burns, Supt.

Tower City, Pa.—H. T. Bressler is reported to be completing arrangements to construct an electric light plant to light Tower City, Williamstown, Lykens, Wiconisco, Reinerton, Johnstown and Reiner City.

Roanoke, Va.—The Stockholders of the Roanoke Gas & Water Co. are reported to have voted to expend about $50,000 in improvements, to include new pump, storage basin and extension of gas and water mains.

Greenville, S. C.—A. G. Furman, of Greenville, Pres. Saluda River Power Co., writes that about $350,000 will be expended by this company. The work will include dam, electric transmission plant to Greenville, 5 miles, 2,600 kw., 6,600 volts. Engineers, Lockwood, Greene & Co.

Shelbyville, Tenn.—It is stated that bids will be received by the Light Com. until June 6 for furnishing 20 or more 2,000 c. p. enclosed arc lights for street lighting purposes, prices being based on a 10-year contract with franchise for commercial lighting at prices proposed by the bidder.

Bryan, Tex.—See "Electric Railways."

McLoud, Okla. Ter.—S. J. Williams is reported interested in the construction of an electric light plant.

Salt Lake City, Utah.—It is stated that John P. Cahoon, owner of the Salt Lake Pressed Brick Yards, will soon let contracts for the construction of an electric power plant, which is estimated to cost, without the transmission line, $40,000.

North Yakima, Wash.—It is stated that work will soon commence on the construction of a gas plant here to cost $50,000. A. B. Whitson, of North Yakima, will be manager.

Uniontown, Wash.—M. J. Shields, of Moscow, Idaho, is reported to have petitioned for a franchise for an electric light plant.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Bluffton, Ind.—The Marion, Bluffton & Eastern Traction Co. is reported incorporated with a capital of $20,000, to build an electric railway in Bluffton and through the counties of Wells and Huntington, connecting Bluffton, Marion, Liberty Center and other cities. Incorporators are Frank F. Van Tuyl, Louis C. Justees, Herbert J. North and others.

Crawfordsville, Ind.—John Bonnell and H. W. McAfee, of Crawfordsville, are reported interested in a plan to build an electric railway from Lafayette to Terre Haute by way of Crawfordsville.

Des Moines, Ia.—The Des Moines Interurban Ry. Co. is stated to have awarded the contract for grading the Woodward and Berry lines to the Ware Constr. Co., of St. Louis, Mo.

Butte, Mont.—It is reported that the Oregon Short Line Co. is considering equipping the 60-mile Minidoka branch of railroad with electricity.

Rome, N. Y.—The Rome & Oneida Electric Ry. Co., with a capital of $150,000, is reported organized to construct an electric railway from Rome to Oneida. De Witt C. Hadcock, Oneida; L. Mittenmaier, Jr., of Rome, are reported interested.

Winston-Salem, N. C.—The proposition to issue bonds to the amount of $37,500 for the building of an electric railway between Winston-Salem and High Point, a distance of 20 miles, is reported to have carried. The promoters of the road say that work on it will begin at once.

Rochester, Ind.—A subsidy of $40,000 was voted in aid of the Logansport & South Bend Traction Co. in Rochester and Liberty Townships, Fuller County.

Laporte, Ind.—It is announced that the Indiana Ry. Co. has decided to purchase the Chicago & South Shore Electric Ry., operating between Laporte and Michigan City, and contemplates constructing the line from South Bend to Laporte.

Indianapolis, Ind.—The Ft. Wayne, Bluffton & Marion Traction Co., capital $550,000, is reported incorporated to build a line from Ft. Wayne to Marion by way of Bluffton.

Ft. Wayne, Ind.—The Toledo & Chicago Electric Co. is reported to have announced that the line, which now reaches from Toledo to Bryan, O., will be extended 50 miles to the west this year. The extension will take in Butler, Waterloo, Auburn, Garrett, Fort Wayne and Kendallville.

Grinnell, Ia.—It is stated that the Grinnel Interurban Ry. Co. contemplates constructing a line from Grinnell to Belle Plaine. The length of the proposed line would approximately be 30 miles.

Canton, Miss.—The Canton & Yazoo City Trolley Co. is reported incorporated to build an electric railway to connect Canton and Yazoo City, a distance of 22 miles. A. P. Cameron, of Canton, Miss.; E. W. Brister, of Edmonville; W. H. Nadler, C. R. Williams and R. H. Cole, of Yazoo City, are reported to be the incorporators.

**Zanesville, O.*—L. G. Halleck, of Wheeling, W. Va., is stated to have secured the contract for building the line of the Southeastern Ohio Railway, Light & Power Co., from Zanesville to Crooksville.

Wauseon, O.—The Ohio Northern Traction Co. is reported formed to build a line from Defiance to Wauseon, and it will probably be extended to Adrian, Mich. Right of way has been secured between Defiance and Wauseon.

Toledo, O.—The Patrick Hirsch Constr. Co., which has the contract for building the Toledo, Ann Arbor & Detroit Railway, states that all contracts for the construction and equipment of the line will be closed before May 21. Bids are being received for the equipment of the power station at Petersburg. It is the intention to complete the road this year.

Wilmington, O.—J. C. Spaite is reported to have under consideration the construction of an electric railway to extend from Wilmington to Hillsboro. He also proposes to build from Wilmington to Spring Valley, where connection will be made for Dayton.

Hamilton, O.—It is stated that the Ohio & Indiana Traction Co. proposes building a line from Hamilton to Richmond, Ind., a distance of 45 miles.

Galion, O.—The Galion Southern Electric Ry. Co. is stated to have secured practically all the right of way for the line from Galion to Fredericktown.

Erie, Pa.—The Benton Harbor & St. Joseph Electric Ry. & Light Co., is reported to have been purchased by Jas. McMichaels, of the St. Joseph River Traction Co., and C. K. Minary, of Springfield, Ill. The new management will expend a large sum in developing the system.

Greensburg, Pa.—It is stated that the Westmoreland Co., operating an electric railway between Latrobe and Derry, contemplates extending the line west to Greensburg and east to Blairsville.

Mt. Joy, Pa.—Town Council is stated to have passed the ordinance granting a franchise to the Lancaster, Rohrerstown & Mt. Joy Electric Ry. Co. The line will run from Mt. Joy to Rohrerstown, to Landisville, to Salunga, to Mt. Joy, to Florin and ultimately to Elizabethtown and Middletown.

West Chester, Pa.—The West Chester, Uwchlan & Pottstown Electric Ry. Co. is stated to have received a charter to build a line from West Chester to Pottstown via West Goshen, West Whitehead, Uwchlan, Upper Uwchlan, West Vincent, East Nantmeal, South Coventry, North Coventry, and running into Pottstown to the intersection with High St. C. Wesley Talbot, Pres., West Chester; Bayard A. Conard, Dir., Font.

Harrisburg, Pa.—The Southwest Missouri Electric Ry. Co., is stated to have in contemplation laying about 10 miles of new track, constructing a sub-station and installing additional equipment at the main power plant.

Lancaster, Pa.—The Lancaster & Eastern Ry. Co. is stated to have secured rights of way desired for its line between Lancaster and Christiana, and construction is expected to begin shortly. The line will be about 17 miles long. Capital, $400,000. The line will follow the Philadelphia Turnpike from this city to Paradise, Leaman Place and Williamstown to Kinzer, after which it will follow the turnpike again through Gap to Christiana, where connections will be made with the Philadelphia, Coatesville & Lancaster Passenger Ry.

Bryan, Tex.—The City Council is stated to have granted franchises to W. P. Connelly, J. W. Batts, J. Allen Myers, G. M. Brandon and J. R. Astin to construct and operate an electric railway over the streets of Bryan; also to erect and operate an electric light plant.

San Marcos, Tex.—The San Marcos Valley Interurban Ry. is reported incorporated with a capital of $500,000 to build and operate an electric railway between San Marcos and Luling, a distance of 24 miles. Incorporators are: C. W. Ohorndorf, of St. Louis, Mo.; A. T. Fisher, of Boston, Mass.; E. J. L. Green, of San Marcos; A. K. Lipscomb, of Luling, and others.

New Martinsville, W. Va.—The Wetzel-Tyler County St. Ry. is stated to have received a franchise to operate in New Martinsville.

Asheville, N. C.—It is stated that bids will be received May 25 by the Asheville & Craggy Mountain Ry. (R. S. Howland, Pres., Goldsboro, N. C.) for building a 6-mile branch to connect Weaverville with the Southern Ry. at Craggy Station and with Asheville. The R. H. Tingley Co., 29 Bway., N. Y. City, are the engrs.

RAILROADS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—A charter has been granted the Bonnerville & Southwestern Ry. Co., with a capital of $1,000,000, to build a line from a point on the Kansas City, Ft. Scott & Memphis in Craighead County through the counties of Craighead, Poinsett, Jackson and Woodruff to a point on the Choctaw, a distance of 55 miles. Directors, Vernon Sharp and Gordon Frierson, of Jonesboro, and Ernest Ritter, of Marked Tree.

Pine Bluff, Ark.—See "Business Buildings."

Van Buren, Ark.—The White Sulphur Springs R. R. Co. is reported incorporated to build a line from Van Buren in a northwestern direction in Crawford County, a distance of 15 miles. Capital, $150,000.

Sacramento, Cal.—The Sacramento Southern R. R. Co. is reported incorporated with a capital of $3,000,000 to build a road from Sacramento to Stockton, with branch lines beginning at Walnut Grove and running in a southwesterly direction to Antioch. Directors, I. W. Hellman, Jr., Chas. Holbrook, J. M. Israel and others.

Denver, Colo.—The Colorado & Southern Ry. Co. (H. W. Cowan, Ch. Engr.) is reported to have decided to build extensions in Texas.

Wilmington, Del.—See "Sewers."

Sandersville, Ga.—W. B. Bennett and Wm. H. Smith of Sandersville, I. Bashinki, of Tennville, and John D. Walker, of Sparta, are reported interested in the construction of a railroad from Sparta to Sandersville.

Oglethorpe, Ga.—Bids will be received until May 20 by Alex. Bonnyman, Ch. Engr., Atlanta, Birmingham & Atlantic R. R., at Oglethorpe, for grading, clearing and grubbing and timbering and concrete in tunnel of about 20 miles of the road through Oak and Pine Mountains from Talbotton, Ga., to Warm Springs, Ga.

Albany, Ga.—The Albany & St. Andrews R. R. Co. is stated to have decided to apply for a charter to build a railroad from Albany to St. Andrews, Fla., touching at Newton, Colquitt and Donaldsonville.

The Albany & Northern R. R. Co. (J. S. Crews, Gen. Mgr., Albany) is stated to have filed with the Secy. of State a petition to extend its road from Albany to Colquitt.

Monmouth, Ill.—The Rock Island Southern R. R. Co., of Rock Island, is reported incorporated, with a capital of $500,000, to construct a line from Monmouth to Galesburg, connecting with Rock Island. Incorporators, J. W. Walsh, John Heron and W. H. Wessel.

Chicago, Ill.—Press reports state that the Chicago & Illinois Western R. R. Co. (B. Thomas, Gen. Mgr., Chicago) has decided to construct a belt line around Chicago.

Upper Marlboro, Md.—The Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia, Pa.) is reported to have decided to eliminate certain grade crossings in Prince George County. Two overhead bridges are to be constructed, one at Tuxedo and the other at a point where the River Road intersects the tracks of the company.

**Cincinnati, O.*—W. J. Oliver, of Knoxville, Tenn., is reported to have secured the contract for double-track work on the Big Four R. R., between Cincinnati and Indianapolis.

Portland, Ore.—The Southern Pacific R. R. Co. (Wm. Hood, Ch. Engr., San Francisco, Cal.) is reported to have decided to expend about $1,450,000 to include improvements along the main lines from Ashland to Portland, new bridges, tracks, etc.

Items marked thus give the names of parties awarded contracts.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

*_Hot Springs, Ark._—J. W. Atkinson, of Colorado Springs, Colo., it is stated, has received the contract to erect the court house at $115,000.

*_Magnolia, Ark._—The Bynum Constr. Co., of Montgomery, Ala., it is stated, has received the contract to erect the court house at $58,631. Other bids received were Bryant & Brown, of Texarkana, $66,865; Robt. O'Neal, of Hope, $66,659.75, and G. W. Pugh, of Texarkana, $67,200.

*_Long Beach, Cal._—The Trus., it is reported, have awarded the contract to erect the convention hall to J. C. Rommell, of Long Beach, at $26,050.

San Francisco, Cal.—It is stated that the Bd. Pub. Wks. is about to petition the Bd. of Superv. for an additional $35,000 for improvements to be made to the plumbing in the City Hall.

Washington, D. C.—All bids opened by the Dept. of Interior (E. A. Hitchcock, Secy.) May 3, for book stacks and cases for the Geological Survey Library have been rejected and new bids will be received May 15.

Jacksonville, Fla.—The City and County Comrs., it is stated, are considering the erection, jointly, of a hospital.

*_McRae, Ga._—McKenzie & Co., of Augusta, it is reported, have received the contract to erect the Telfair County Court House at $42,000.

Ft. Screven, Ga.—Bids will be received by Jos. T. Davidson, Q. M. U. S. A., Savannah, May 19, for constructing hot water, heating, plumbing and electric wiring hospital at Ft. Screven, as advertised in The Engineering Record.

Honolulu, H. I.—Bids will be received until June 7 by A. W. Butt, Depot Q. M., U. S. A., Washington, D. C., for constructing, plumbing and electric wiring about 25 buildings to be erected on the Military Reservation at Kahauiki, near Honolulu.

Wallace, Idaho.—The Co. Comrs. have accepted the plans of Stritesky & Sweatt, Spokane, Wash., for the court house which is to be erected at a cost of $60,000.

Chicago, Ill.—Bids will be received May 16 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.) for furnishing materials and doing all the cut stone work necessary to erect a 2-story and basement public bath house, at 247 W. Chicago Ave.; separate bids will be received same date for steamfitting for said building.

Bids will be received May 16 by the Dept. Pub. Wks. (Jos. M. Patterson, Comr.) for furnishing material for doing all sheet metal work and roofing necessary in connection with the erection of a 2-story and basement public bathhouse, at 247 W. Chicago Ave.; also on same date for plumbing, sewerage and gasfitting in said building.

The Co. Bd. has invited archts. to submit plans for a county building to cost $5,000,000.

Clinton, Ill.—A. L. Pillsbury, of Bloomington, Ill., it is stated, has been engaged to prepare plans for a library which it is proposed erecting at a cost of $25,000.

Springfield, Ill.—It is reported that a bill has passed both the House and Senate appropriating $121,800 for repairing the State House.

A bill has passed the Assembly, authorizing the construction of a Supreme court building at Springfield at a cost of $350,000, and appropriating $150,000 to begin the work. Also providing for a commission, etc., to do the work; also appropriating $53,000 for permanent buildings and improvements in the State Bd. of Agriculture and the State Fair Grounds.

Jacksonville, Ill.—The following are the bids opened by the Superv. Archt., Treas Dept., Washington, D. C., for the construction of U. S. Post-Office at Jacksonville: M. Yeager & Son, Danville, $45,296; Edw. Henry, Tipton, Ind., $47,200; J. A. Simpson, Lincoln, $46,610; W. J. McAlpine, Dixon, $44,354; English Bros., Champaign, $44,627; W. J. Turner Co., Chicago, $44,933, and V. J. Obst & Sons, Peoria, $41,700.

Petersburg, Ind.—The Co. Council has appropriated $25,000 for the erection of a county poor asylum.

Peru, Ind.—It is reported that the Co. Comrs. are about to have plans prepared for a court house.

Shelbyville, Ind.—It is reported that bids will be received May 18 by Thos. Yates, Co. Aud., for a light, heat and water plant for court house and jail.

South Bend, Ind.—It is stated that plans are soon to be submitted to the Bd. of State Charities (Amos W. Butler, Secy.) at Indianapolis, for the new St. Joseph Poor Farm, which it is proposed erecting at a cost of $150,000.

Hartford City, Ind.—It is reported that the Bd. Co. Comrs. will receive bids until May 20 for additions and improvements to the courthouse; L. L. Johnson, Co. Aud.

*_Anamosa, Ia._—The following are reported to be the bids received by the State Bd. of Control at Des Moines, for furnishing the material for steel cells at the new cell house at Anamosa Prison: E. P. Smith Wire & Iron Works, Chicago, Ill., $42,184; Herzog Iron Wks., St. Paul, Minn., $40,440; White Head, Kales, Detroit, Mich., $33,336; Mesker Bros., St. Louis, Mo., $33,327, and Champion Iron Wks., Kenton, O., $33,000 (awarded contract.)

Des Moines, Ia.—The Bd. of Superv., it is stated, has decided to erect the Polk County jail on the site adjoining the court house.

Gretna, La.—The erection of courthouse is reported under consideration.

Leesville, La.—It is stated that bids will be received until July 3 by the Police Jury of Vernon Parish (J. J. Cryer, Pres.) for making improvements to the court house and jail.

*_Baltimore, Md._—W. F. Shinnick, it is reported, has received the contract to erect engine house No. 26 at $19,763, and Henry S. Rippel, 7 Clay St., the contract to erect engine house No. 27 at $18,264.

5th Ave., are the archts.

Bids will be received May 31 by the Bd. of Awards (E. Clay Timanus, Pres.) for alterations in west facade of the court house for the City of Baltimore; probable cost, $125,000. Wyatt & Nolting, archts., 2 E. Lexington St.

Boston, Mass.—The following are the bids opened on Apr. 29 by the Bureau of Yards & Docks, Navy Dept., Washington, D. C., for fireproof floors and stairways for Bldg. No. 42, Navy Yard, Boston (each bid contains certain deductions and modifications): Jas. W. McArdle, 95 Milk St., $49,643; C. M. Leach, Navy Yard, Boston, $21,983; Coleman Bros., Everett, $22,470; Atlas Reinforced Concrete Constr. Co., $46,908 and Simpson Bros. Corp., 166 Devonshire St., $36,122.

Springfield, Mass.—The Co. Comrs., it is stated, have decided upon a site for the new Hall of Records, and will soon receive plans for the building.

Howell, Mich.—Bids will be received May 18 by the Free Pub. Library Bd. (M. J. McPherson, Chmn.) for furnishing materials and completing Carnegie Library, including plumbing, heating and electric work.

Bay City, Mich.—Pratt & Koeppe, 514 Crapo Bldg., it is stated, have completed plans for an infirmary to cost $20,000.

Winona, Minn.—Bids will be received May 17 by the Bd. Co. Comrs., for erecting a poor house; John Winczewski, Co. Aud.

Red Wing, Minn.—L. A. Lamoreaux, Minneapolis, it is reported, is the archt. for the 2-story and basement brick and terra cotta city hall which is to be erected here at a cost of $25,000.

Minneapolis, Minn.—The Soldiers Home Bd., it is stated, is about to have plans prepared for a dormitory building which it is proposed to erect at the Minnehaha Home and for which $75,000 has been appropriated.

St. Paul, Minn.—The Council, it is stated, has agreed to donate $150,000 toward the erection of a $300,000 auditorium.

Jackson, Miss.—Kruse & Shaw, of Meridian, have completed plans for an Orphans Home to be erected here for the M. E. Assoc., to cost about $30,000.

St. Louis, Mo.—Bids will be received at the office of the Custodian, for installing a mechanical ventilating apparatus in the boiler room of the custom house and post-office here.

Savannah, Mo.—It is reported that bids are wanted until May 19 for erecting a jail and sheriff's residence. Probable cost, $15,600. Geo. E. McDonald, Archt., Warrensburg, Mo.; Christian Yenni, Judge.

*_Seward, Neb._—Maixen & Rokahar, it is stated, have received the contract to erect the court house at $80,350.

Trenton, N. J.—The Bd. of Mgrs. has approved the preliminary plans for the $250,000 addition to be erected at the State Hospital for the Insane in this city. The plans provide for 2 stone wings, each 3 stories high, 300x50 ft.

Jersey City, N. J.—The Finance Com. has directed the sale of $200,000 bonds for the purchase of a site and the erection of a hospital.

New York, N. Y.—The date of opening of bids for the mechanical equipment of the U. S. Custom House has been extended from May 9 to May 19, as advertised in The Engineering Record.

Bids will be received May 17 by the Dept. Pub. Charities (Jas. H. Tully, Comr.) for furnishing materials and making certain alterations and additions to Stryker Memorial Laboratory, City Hospital, Blackwell's Island; putting a new roof, leaders and gutters on Wards 14-16, and installing a new boiler in central power house, Randall's Island.

The following are the bids opened on May 8 by the Superv. Archt., Treas. Dept., Washington, D. C., for interior finish of U. S. Custom House at New York: V. J. Hedden Sons Co., New York, N. Y., $1,641,498; R. C. Fisher, New York, N. Y., $1,619,000; John Pierce, New York, N. Y., $1,299,000; R. E. Heningham, Brooklyn, $1,617,000, and J. C. Robinson, Chicago, Ill., $1,277,358.

Plans have been filed for a 4-story brick and stone library which is to be erected at 121 to 127 E. 58th St., at a cost of $75,000; owner, the N. Y. Pub. Library, Astor and Tilden Foundations; archt., Babb, Cook & Willard, 3 W. 29th St.

Raymond F. Almirall, 51 Chambers St., it is stated has completed plans for a municipal lodging house to be erected at 25th St. and First Ave., at a cost of $175,000.

Bids will be received May 22 by Nicholas J. Hayes, Fire Comr., for furnishing materials and making additions and alterations to Engine Co. No. 20, Boro. Manhattan.

The Bd. of Aldermen has approved the $850,000 appropriation by the Bd. of Estimate & Apportionment in March for the beginning of work on the new Bellevue Hospital. This appropriation is to be devoted to the construction of the southeast wing, which is to be of Harvard brick with limestone trimmings. This wing is to contain two parallel pavilions, each 150x36 ft., to be connected with an administration building, 140x32 ft. Each building to be 7 stories high. The total cost of the new Hospital is estimated at $8,500,000, and is to consist of 11 pavilions. Dr. John W. Brannan, Pres. Bd. Trus., Bellevue and Allied Hospitals; McKim, Mead & White, 160 5th Ave., are the archts.

Governor Higgins has signed a bill authorizing this city to appropriate an additional $40,000 for the American Museum of Natural History; also a bill authorizing the Comr. of Corrections of New York City to remove the Kings County Penitentiary and to construct a city prison upon an island in the East River. The removal and erection of a new prison are to be consummated within two years. Bonds to the amount of $300,000 are authrized to be issued to provide funds for carrying out the act.

Brooklyn, N. Y.—Bids will be received May 17 by the Bd. Health, N. Y. City (Thos. Darlington, M. D., Pres.) for furnishing materials and erecting a stable at the Kingston Ave. Hospital, Boro. Brooklyn.

Watertown, N. Y.—The Bldg. Com. of the Bd. of Superv., it is stated, has accepted the plans of D. D. Kieff, 24 Flower Bldg., for remodeling the County House, the cost to be about $20,000.

Pelham, N. Y.—The town has been authorized by the signing of a bill by the Governor, to erect a town hall at a cost of $25,000.

Elmira, N. Y.—Governor Higgins has signed the bill appropriating $115,000 to replace buildings at the State Reformatory which were recently destroyed by fire.

Mt. Vernon, N. Y.—A bill has been signed by the Governor authorizing the issue of $100,000 bonds for the purchase of sites and the erection of buildings for the Police and Fire Depts.

Grand Forks, N. D.—Mrs. Andrew Holes, it is reported, has ordered plans prepared for a building to be used as the Home for Aged People, the cost to be about $30,000.

*_Jamestown, N. D._—The Northwestern Constr. Co., of Wahpeton, it is stated, has received the contract to erect a ward building at the State Asylum for the Insane here at $24,497. Other bids received are stated to have been as follows: Bowers Bros., Fargo, $20,115; Stewart Wilson, Fargo, $25,892; Hoagland Bros., $25,985; Johnson & Powers, Fargo, $26,599; Duncan McDonald, Valley City, $26,447, and M. Peterson, Jamestown, $30,996.

Hillsboro. N. D.—Peter Davidson, Co. Aud., writes that all bids opened in May 3 for erecting a court house have been rejected. Bids will probably be called for again in January.

Cleveland, O.—The Council, it is reported, has decided to purchase 110 acres in Warrensville and intends erecting a detention hospital.

Philadelphia, Pa.—A building permit has been granted to Cramp & Co., 1421 Filbert St., to erect a 4-story stone addition to the Old Men's Home, to cost $60,000.

Newport, R. I.—Bids will be received until May 23 by H. N. Manney, Ch. of Bureau of Equipment, Navy Dept., Washington, D. C., for constructing a machine shop and power house at U. S. Naval Coal Depot, Narragansett Bay, Newport.

Florence, S. C.—The lowest bid opened on May 6 by the Superv. Archt. Treas. Dept., Washington, D. C., for heating apparatus for U. S. Post-Office at Florence was submitted by the Crawford Htg. & Supply Co., of Winston, N. C., for $2,250.

Centreville, Tenn.—Bids will be received until May 18 by the Co. Court Clk., for erecting a jail.

Ft. Worth, Tex.—It is reported that the Sisters of the Incarnate Word intend erecting a 3-story brick wing to the St. Joseph Infirmary at a cost of $30,000.

*_Steilacoom, Wash._—Contracts for erecting an addition to the Insane Asylum at Steilacoom (bids opened May 1) have been awarded as follows: General contract, 2 ward buildings, to Hastie & Dougan, Tacoma, $78,765; steam heating to Seattle Htg. & Plumbing Co., of Seattle, $4,400, and plumbing to Wm. G. Anstey, of Seattle, $2,940. Architects, Proctor & Farrell, Natl. Bank of Commerce Bldg., Tacoma.

*_Superior, Wis._—O. H. Olsen, of Stillwater, Minn., has secured the contract for erecting the U. S. Post-Office at Superior (bids opened Mar. 28) at $167,900, not including elevators, heating apparatus, electric wiring or conduits.

Manitowoc, Wis.—It is reported that bids are wanted until May 23 for erecting a Bedford stone courthouse. Probable cost, $150,000. C. H. Tegen, Archt., Manitowoc; Edw. Schaffland, Co. Clk.

Darlington, Wis.—It is reported that bids will be received May 31 by the Bd. Co. Comrs. (Geo. F. West, Chmn.) for erecting a 2-story stone courthouse. Probable cost, $115,000. F. W. Kinney, Archt., Minneapolis, Minn.

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Birmingham, Ala.—J. Blach & Sons, it is stated, have secured a permit to erect a 4-story brick store building at 3d Ave. and 19th St. N. at a cost of $40,000.

Huntsville, Ala.—The Elk Theatre Bldg. Co., it is reported, has accepted the plans of Wm. W. Knowles of N. Y. City, for the theatre and office building and Elk Home, which they propose erecting at a cost of $50,000.

*_Clarksville, Ark._—E. T. McConnell, it is stated, has received the contract to erect a $25,000 hotel for the Clarksville Hotel Co.

Pine Bluff, Ark.—The City Council has accepted the plans submitted by the St. Louis, Iron Mountain & Southern Ry. Co. (E. F. Mitchell, Engr. of Construction, St. Louis, Mo.) for the new passenger station and freight depot which are to be erected here at a cost of $25,000 and $20,000 respectively. Other improvements contemplated by this road in this city include rearrangement of tracks, cost $15,000; macadam on 4th Ave., $30,000; water tank, $5,000; track connections, $3,000; platform, $1,500, and freight tracks, $3,000.

*_Daggett, Cal._—Olmstead & Poulson, of Los Angeles, it is reported, have received the contract to erect a roundhouse for the San Pedro, Los Angeles & Salt Lake R. R., near here, at $25,516.

Bakersfield, Cal.—The Elks' Hall Assoc., it is reported, has decided to erect a theater, lodge room and hall on Chester Ave., estimated to cost $50,000.

San Francisco, Cal.—It is reported that the building of the Arizona Warehouse Co. has been destroyed by fire.

Sacramento, Cal.—The members of the Turn Verein, it is reported, have decided to improve Turner Hall at a cost of $20,000, and are having plans prepared by R. A. Herold, Stoll Blk.

Santa Barbara, Cal.—C. W. Alisky, Pres. of the California Amusement Co., it is reported, is making arrangements to erect an opera house here to cost $50,000.

Wilmington, Del.—The members of the Lodge of Elks, it is stated, are contemplating the erection of a home to cost about $30,000.

Washington, D. C.—John Mariner, of Norfolk, Va., it is stated, has purchased a site adjoining the Builders' Exchange on 13th St., and intends erecting a 7-story office building to cost $200,000.

*_Cordele, Ga._—The W. T. Hadlow Co. of Jacksonville, Fla., it is reported, has received the contract to erect a $20,000 freight depot here for the Seaboard Air Line Co.

Waycross, Ga.—The erection of a Y. M. C. A. building in this city to cost $25,000 is reported under consideration.

*_Macon, Ga._—The contract to erect a 3-story addition to the American National Bank, it is reported, has been awarded to Griffin & Fitts, of Atlanta, at about $50,000.

***Items marked thus give the names of parties awarded contracts.**

Wallace, Idaho.—Galbraith & Hals, it is stated, have prepared plans for a 3-story temple to be erected for the Eagles at a cost of $30,000.

Hoopeston, Ill.—McCoy & Stuebe, of Danville, it is stated, are preparing plans for a 5-story business block which J. S. McFerren intends erecting at a cost of $50,000.

Chicago, Ill.—The La Salle Theatre, at 137 Madison St., is to be remodeled and enlarged according to plans prepared by Marshall & Fox, at a cost of $150,000.

Henry L. Ottenheimer, 1109 Randolph St., is preparing plans for a warehouse to be erected at Dayton and Blackhawk Sts., for the Cross Press and Sign Co. The building will be 4 stories high, 100x176 ft., of mill construction and cost $100,000.

Evansville, Ind.—Jas. Scarbrough, it is reported, submitted the lowest bid for erecting the Elks' Home at $53,000.

Indianapolis, Ind.—S. E. and Henry Paugh, it is reported, have ordered plans prepared for a 5-story business building to be erected on South St.

**Columbus, Ind.*—Dunlap & Co., of Columbus, it is stated, have received the contract to erect the Knights of Pythias hall, which is to cost about $20,000.

Washington, Ind.—It is reported that bids are wanted until June 2 for erecting a lodge building for the Knights of Columbus; probable cost, $50,000. W. G. Gearse, Secy.

Mt. Vernon, Ind.—Saml. Hannaford & Sons, of Cincinnati, O., it is stated, have been engaged to prepare plans for a bank building to be erected here at a cost of $25,000.

**Des Moines, Ia.*—J. Tusant, 616 High St., it is stated, has received the contract to erect the 6-story and basement Garver Bldg. on Locust St., at about $60,000.

Iowa City, Ia.—The Masons of the city are said to be contemplating the erection of a building to cost $35,000.

New Orleans, La.—It is stated that the Le Barronne Hotel Realty Co. (Chas I. Denechaud, Secy.) is about to be incorporated with a capital of $250,000, and intends erecting the Denechaud Hotel at Baronne, Perdido and Carroll Sts. It is reported that plans are being prepared for the hotel, which will probably be a 10-story structure containing about 300 rooms.

**Baltimore, Md.*—A building permit has been granted to the Singer Mfg. Co. to erect a 6-story brick building at 109 W. Lexington St., at a cost of $72,000. Noel Constr. Co., builders. Also to the Maryland Bible Society, to erect a 5-story store building at 12 E. Fayette St., to cost $42,000. Marrow Bros., 212 Clay St., builders.

The Columbia Amusement Co., of New York City, it is stated, has purchased a site at Baltimore St. and Post Office Ave., and intends erecting a burlesque theater to cost about $150,000.

Springfield, Mass.—F. R. Richmond, 115 State St., it is stated, has prepared plans for a 4-story hall which is to be erected by the Hampden Lodge of Odd Fellows.

Orange, Mass.—The members of the Odd Fellows Lodge, it is stated, have decided to purchase the Putnam Opera House Blk. and to rebuild it at a cost of $30,000.

Highland Park, Mich.—It is reported that the Detroit United Ry. Co. (Harry Bullen, Gen. Supt., Detroit) is contemplating the erection of a storage building at Woodward and Cortland Aves., to cost about $60,000.

Gulfport, Miss.—The members of the Gulfport Lodge, No. 422, F. and A. M., it is stated, have decided to organize the Masonic Temple Assoc., with a capital of $50,000 for the purpose of erecting either a 3 or 4-story brick lodge and commercial building at 25th Ave. and 13th St., at a cost of about $35,000.

Jackson, Miss.—Jones-Kennington Co. are having plans made for a 6-story department store to cost about $40,000.

**Minneapolis, Minn.*—The H. N. Leighton Co., 213 S. 6th St., it is stated, has received the contract to erect the H. Alden Smith Bldg. at 3d Ave. S. and 5th St., at a probable cost of $45,000. A. L. Dorr, Archt., Lumber Exchange.

Bertrand & Chamberlin, Bank of Commerce Bldg., it is reported are preparing plans for a building to be erected at 5th St. and 4th Ave. for the Minneapolis Paper Co. It is to be 5 story and basement, 66x155 ft. of brick and terra cotta, and to cost about $50,000.

*August Cederstrand & Co., 934 Central Ave., it is stated, have secured the contract to erect the Grau-Curtis Co.'s furniture warehouse at 7th and Central Aves., which is to be 4 story and basement, of pressed brick and stone, and to cost $20,000. Arnold & Koercher, Archt.

Kansas City, Mo.—It is reported that the Missouri, Kansas & Texas Terminal Co. (Fredk. N. Finney, of Milwaukee, Wis., Pres.) has been incorporated with a capital of $100,000 for the purpose of erecting a union depot.

St. Louis, Mo.—A building permit has been granted to N. Peligreen to erect a 2-story store and flat building at Grand Ave. and Arsenal St., at a cost of $30,000.

Booneville, Mo.—It is reported that Chas. E. Sombart, of Booneville, has completed arrangements for the erection of a $40,000 hotel here.

Jersey City, N. J.—The Jersey City Golf Club, it is stated, is contemplating the erection of a club house at a cost of $20,000.

Plainfield, N. J.—The Plainfield Trust Co., it is stated, has approved the plans of D. Kramer Thompson, for the 1-story building which it is proposed erecting at Park Ave. and W. 2d St., at a cost of $60,000. Henry A. McGee is Chmn. Bldg. Com.

New York, N. Y.—Plans have been filed for an 8-story fireproof building which is to be erected at 247 and 249 W. 54th St., for the Automobile Club of America (Dave H. Morris, Pres.), at an estimated cost of $350,000. Ernest Flagg, 35 Wall St., is the archt.

**Syracuse, N. Y.*—The Syracuse & South Bay Ry. Co. has awarded to Frank Gilbreth, of Boston, Mass., the contract for constructing the car house and electric substation at North Syracuse for $32,000.

Oneida, N. Y.—The Odd Fellows, it is stated, are contemplating the erection of a $20,000 lodge building. Address Secy.

Cando, N. D.—L. A. Lamoreaux, of Minneapolis, Minn., it is reported, is the archt. for a 2 story and basement brick and terra cotta bank, which is to be erected here at a cost of $20,000.

Toledo, O.—It is reported that Geo. G. Metzger has commissioned Arnold Johnson to prepare plans for remodeling the National Union Bld. on Huron St., the cost to be about $200,000.

Ashtabula, O.—The greenhouse owned by Dunbar & Hopkins and Roger Griswold, Jr., it is reported, is to be enlarged at a cost of $23,000.

New Philadelphia, O.—It is reported that plans have been completed for the depot which the Baltimore & Ohio R. R. intends erecting here, and bids for its construction will soon be asked. D. D. Carothers, of Baltimore, Md., is Chief Engineer.

Chillicothe, O.—Saml. Hannaford & Sons, of Cincinnati, O., it is reported, have been engaged to prepare plans for a home for the Elks which is to cost $25,000.

Youngstown, O.—The Republic Iron & Steel Co., it is stated, has approved plans for a 5-story fireproof office building which they intend erecting in this city at a cost of $60,000.

**Cadiz, O.*—A. F. Wendling & Co., of Massillon, it is stated, have received the contract to erect the 3-story limestone building for the Fourth Natl. Bank, the total cost of which is to be about $30,000.

Okmulgee, Okla. Ter.—The Chamber of Commerce, it is stated, has completed arrangements for the erection of an opera house here to cost $40,000.

Philadelphia, Pa.—It is stated that the members of the Philadelphia Racquet Club have purchased a site on 16th St. and intend erecting a building to cost about $250,000.

Philadelphia, Pa.—A building permit has been granted to Cramp & Co., 1421 Filbert St., to erect a 4-story warehouse, 232x86 ft., at American, Master, Cadwalader and Jefferson Sts., for the Crane Co., to cost $100,000. Ballinger & Perrot, 102 S. 12th St., are the archts.

Memphis, Tenn.—R. Brinkley Snowden, it is stated, is the promoter for a warehouse which it is proposed erecting at the foot of Linden St. The cost, including ground, will be about $400,000. The plans include the erection of 13 separate buildings.

Chattanooga, Tenn.—It is reported that a stock company is being formed in which J. Fred Ferger & Bro., real estate dealers, are interested, for the purpose of erecting a 10-story brick and stone office building to cost about $250,000.

Bristol, Tenn.—It is stated that the erection of a Y. M. C. A. bldg., at a cost of $40,000, is under consideration.

**Waco, Tex.*—J. S. Hunter, Gen. Secy. Y. M. C. A., writes that the contract for erecting a Y. M. C. A. Bldg. here (bids opened May 4) has been awarded to H. W. Hubby, of Waco, for $25,600.

Dallas, Tex.—A building permit has been granted to J. C. O'Connor to erect at Elm and Lamar Sts., a 2-story building to cost about $20,000.

**Salt Lake City, Utah.*—E. J. Humphries, it is stated, has received the contract to erect the Masonic Temple at $31,950. This does not include heating, lighting and plumbing.

Tacoma, Wash.—The following are reported to be the bids recently received for erecting the Johnston Temple of Music: Cowen & Black, $25,596; O. F. Larson, $25,919; Hasty & Dugan, $26,099; J. E. Bonnell; $26,350; John Huntington, $26,429; Chas. Sayre, $26,690; Cornell Bros., $26,915; Miller & Bishu, $27,300.

Walla Walla, Wash.—Dr. H. R. Keylor, it is stated, is having plans prepared for a theater which is to be erected at Alder and 4th Sts., at a cost of $40,000.

**Colfax, Wash.*—J. R. Good & Co., of Colfax, it is reported, have been awarded the contract to erect a 2-story store building, 90x100 ft., at Main and Spring Sts., for Lippitt Bros., at $23,475.

La Crosse, Wis.—It is reported that several buildings in the wholesale dist. have been destroyed by fire, including the 4-story brick structure of the Spence-McCord Drug Co.

Brantford, Ont.—It is reported that the Bell Telephone Co. will erect a building on Dalhousie St. to cost $40,000.

Ottawa, Ont.—A. F. Maclaren, it is reported, is interested in the erection of a $1,000,000 hotel here.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—The Church Bd. of the Court St. Methodist Church, it is reported, has accepted the plans of B. B. Smith, Moses Bldg., for the remodeling of the church at a cost of $25,000.

Denver, Colo.—The members of the Spiritualists Church, it is stated, have decided to erect an edifice to cost $20,000. A. P. Roberts, 1338 Stout St., may be able to give further information.

Alonzo Thompson, it is stated, has had plans prepared for a residence which he intends erecting at 11th Ave. and Humboldt St., at a cost of $30,000.

C. F. Wilfey, it is stated, has purchased a site at 13th Ave. and William St. and intends erecting a residence to cost $25,000.

Canton, Ill.—The Trus. of the Presbyterian Church, it is stated, have decided to erect an edifice to cost $20,000.

Chicago, Ill.—It is reported that plans are being prepared for a new edifice for the Woodlawn Ave. M. E. Church which is to be erected at 64th St. and Woodlawn Ave., at a cost of $50,000. Rev. John D. Leek, Pastor.

Worthman & Steinbach, 625 W. Chicago Ave., are the architects of a new church to be built at N. Hoyne Ave. and Cornelia St., for St. John's Evangelical Lutheran congregation. It will be of pressed brick and stone, 65x104 ft. In connection with the church a 2-story schoolhouse is to be built. The total cost will be about $75,000.

R. A. Griefen is to build 2 apartment houses at Evanston Ave. and Edgecomb Court at a cost of $160,000. Each building will be 100x100 ft.

Loring W. Craig is to build an apartment house in Warren Ave., near Garfield Boule. It will be 4 stories high, 134x122 ft., and cost $110,000.

**Kewanee, Ill.*—Edgar S. Miner, of Kewanee, it is stated, has received the contract to erect an edifice for the Baptist Congregation, to cost, including heating, $28,970.

O'Fallon, Ill.—Bids are wanted until May 20 for rebuilding the German Evangelical Church; address Rev. F. Egger, O'Fallon, Ill.

Des Moines, Ia.—C. C. Cross & Son, Good Blk., it is stated, are preparing plans for an edifice which is to be erected by the congregation of the Forest Ave. Baptist Church at W. 11th St. and Forest Ave. Probable cost, $20,000.

A site at 10th and Pleasant Sts. has been selected on which it is proposed erecting a new edifice for the First Methodist Church, which is to cost about $100,000. Geo. W. Marquandt is a member of the Bd. Trus.; Dr. E. T. Hagerman, pastor.

Indianapolis, Ind.—It is reported that R. P. Daggett & Son, Marion Blk., are preparing plans and will receive bids for remodeling the Second Presbyterian Church. Estimated cost $30,000.

Parsons, Kan.—It is reported that the members of the Presbyterian Church have decided to erect an edifice at a cost of $25,000.

Baltimore, Md.—Wm. B. Ehlen, it is stated, has engaged Geo. A. Nagle to prepare plans for an apartment house which is to be erected at Lanvale St. and Arlington Ave., at a cost of $200,000.

Pittsfield, Mass.—It is reported that Mrs. Elizabeth Cooledge, of Chicago, Ill., intends erecting a residence here to cost $30,000.

Greenville, Miss.—Bids will be received May 22 by the Bldg. Com., at Lemler & Mayor's insurance office (Max Lemler, Chmn.) for erecting a brick and stone synagogue.

Independence. Mo.—It is reported that the Latter Day Saints intend erecting an edifice to cost $40,000. Address Bishop May, Independence.

St. Louis, Mo.—The St. Margaret R. C. Church, it is reported, intends erecting an edifice at Vanderventer and Fland Aves., to cost $60,000. Rev. J. J. O'Brien, Pastor.

New York, N. Y.—Ludlow & Valentine, 1 E. 27th St., have been appointed architects for the new building for the Bloomingdale Reformed Church, which now stands at 68th St. and Bway. The old building is to be torn down and the facade of the new building worked up to a certain extent from the stonework of the present building.

Plans have been filed for remodeling the 4-story dwelling belonging to Mrs. Josephine Morgenthau, at 30 W. 72d St., the cost to be about $25,000. Buchman & Fox, 11 E. 59th St., are the archts.

**Manhasset, L. I., N. Y.*—Bishop & Co., of Boston, Mass., it is stated, has secured the contract to erect a stable here for Payne Whitney to cost $60,000 and Frank Pelcher, of Manhasset, the contract for the dairy and cow barn at $16,000.

**Tuxedo, N. Y.*—J. S. Cornell & Son, of Philadelphia, Pa., it is stated, has secured the contract to erect a residence here for W. P. Hamilton, at a cost of $150,000.

Fargo, N. D.—The plans of M. E. Bebee, of Fargo, it is stated, have been accepted for the new edifice, which is to be erected by the First Presbyterian Church, at a cost of $30,000.

Youngstown, O.—It is reported that the members of the Wilson M. E. Church intend erecting a new edifice at a cost of $50,000.

**Steubenville, O.*—Andrews Bros., of Cleveland, it is reported, have received the contract to erect St. Peter's Church, at $76,800.

Cleveland, O.—Mrs. J. V. Painter, it is reported, is having plans prepared for a residence which is to be erected on Shaker Heights, at a cost of $20,000.

Mansfield, O.—Vernon Redding, of Mansfield, it is stated, is the archt. for a 2-story flat which is to be erected on 2d St., at a cost of $55,000.

Marion, O.—A $40,000 edifice, it is stated, is to be erected for the Free Baptist Church congregation. Rev. G. E. Barnard, Pastor.

Homestead, Pa.—It is stated that a $40,000 edifice is to be erected on McClure St. by the congregation of St. Francis German Catholic Church. The plans include a parochial school and residence.

Pittsburg, Pa.—The Rodeph Shalom Congregation, it is stated, is preparing to erect a $200,000 synagogue at 5th and Morewood Aves.

Mitchell, S. D.—The members of the R. C. Church, it is stated, have decided to erect an edifice to cost, including furnishings, etc., about $40,000.

Richmond, Va.—It is reported that the congregation of the Church of the Covenant has decided to erect an edifice at a cost of $24,000.

**Sistersville, W. Va.*—The contract to erect the M. E. Church, it is reported, has been awarded to Beardsley & Foreman, of Marietta, O., at $18,000.

Beloit, Wis.—The Trus. of the First Presbyterian Church, it is reported, have accepted the plans of H. C. Koch & Sons, of Milwaukee, for a new edifice, which it is proposed erecting at a cost of $40,000.

Milwaukee, Wis.—Leenhouts & Guthrie, 102 Wisconsin St., it is stated, have prepared plans for a brick apartment house which is to be erected at 9th and Wells Sts., at a cost of $25,000.

Montreal, Que.—Plans have been filed for a convent which, it is stated, is to be erected by the Sisters of the Notre Dame on Sherbrooke St., at a cost of about $1,500,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

**Birmingham, Ala.*—The Poull Constr. & Bldg. Co., it is stated, has received the contract to erect the South Highland Grammar School at $19,513.

The Bd. Educ. has decided to reject all bids received May 3 for erecting the Barker School, as they exceeded the amount available, which is $20,000.

New Haven, Conn.—It is stated that bids will be received until May 19 by the Bd. Educ. (G. T. Hewlett, Secy.) for erecting a school at Orchard and Scranton Sts.

Items marked thus give the names of parties awarded contracts.

Springfield, Ill.—A bill has passed the Assembly appropriating $125,000 to complete the Western Illinois Normal School.

Indianapolis, Ind.—Bids will be received May 26 by the Bd. School Comrs. (John E. Cleland, Business Dir.) for furnishing material and installing the ventilating, heating and plumbing in new and old buildings at Public School No. 52; Rubush & Hunter, Archts., Fitzgerald Bldg.

Lafayette, Ind.—The Trus. of Purdue Univ., it is stated, have decided to erect a gymnasium, will soon ask bids for its construction. Estimated cost, $65,000.

Tipton, Ind.—It is stated that bids are wanted May 26 by the Bd. Educ. for erecting a 3-story high school, 125x80 ft., to cost about $40,000. Eberson & Finan, 125 N. 10th St., Hamilton, O., are the archts.

Columbus, Ind.—It is reported that bids are wanted until May 20 for erecting a 2-story school; E. E. Dunlap, archt., Columbus; David Stillinger, Trus. Columbus Township.

Muskogee, Ind. Ter.—The City Council has voted in favor of issuing $75,000 school bonds and $100,000 water and sewer extension bonds.

Jefferson, Ia.—It is reported that J. G. Ralston, of Waterloo, has prepared plans for a $20,000 school.

Lyons, Ia.—Temple, Burrows & McLane, of Davenport, it is reported, have been commissioned to prepare plans for a $40,000 brick high school.

Manchester, Ia.—Thos. T. Carkeek, of Dubuque, is preparing plans for an addition to the Central School to cost $10,000.

Marble Rock, Ia.—It is reported that bids will be received May 29 by the School Bd. (H. B. Nies, Clk.) for erecting a 2-story brick school. Separate bids will be received for plumbing.

Jefferson, Ia.—Press reports state that bids will be received until about May 29 for erecting a 2-story brick high school, 57x88 ft., to cost $200,000. J. G. Ralston, archt., Waterloo, Ia.

Donaldsonville, La.—The citizens on May 6, it is stated, voted in favor of issuing $25,000 toward the erection of a high school. It is expected that the Police Jury will appropriate a similar sum, making a total of $50,000 available for the school.

**Baltimore, Md.*—It is reported that Chas. Stockhausen, 208 Patterson St., has received the contract to erect an addition to School No. 99 at $26,549, and to erect School No. 96 at $82,950, and school at Lakewood Ave. and Oliver St., at $89,000.

Medford, Mass.—The Bd. of Aldermen has appropriated $28,000 for the erection of a school on site of present James School.

St. Paul, Minn.—It is reported that $408,000 has been appropriated for buildings at the State Univ.

A permit has been issued for a 2-story brick addition to Whittier School on Albemarle and Milford Sts., to cost $20,000.

The School Bd. has passed a resolution requesting the Common Council to issue $150,000 bonds for the erection of high school buildings.

Fairfax, Minn.—Press reports state that bids are wanted until May 25 for erecting a 10-room high schol. Probable cost, $30,000.

**East Grand Forks, Minn.*—Contracts are reported to have been awarded as follows for erecting an addition to the Central School: Dinnie Bros., Grand Forks, N. D., for the general construction at $23,918; heating plant to F. L. Dixon, of Grand Forks, N. D., at $5,297, and plumbing also to F. L. Dixon at $1,298.

Northfield, Minn.—President Sallmon, of Carleton College, it is stated, has announced that $100,000 has been given to the college, $50,000 of which is to be used for the erection and equipment of a science hall.

Minneapolis, Minn.—Bids will be received May 25 by the Com. on Ways and Means of the City Council for $200,000 school improvement bonds. Dan. C. Brown, City Compt.

**Warrensburg, Mo.*—The Bd. of Regents of the State Normal School, it is reported, has awarded the contract for the power house and manual training department to Oscar Thomas, of Sedalia. Probable cost, $20,000.

Newark, N. J.—Bids will be received May 23 by the Com. on Schools, Bd. Educ. (R. D. Argue, Secy.) for furnishing materials and erecting Belmont Ave. School; probable cost, $130,000 (Hurd & Sutton, Archts., Prudential Bldg.); 14th Ave. School; probable cost, $90,000; (Frank F. Ward, Archt., 239 Roseville Ave.); Elliot St. School; probable cost, $78,000 (Chas. P. Baldwin, Archt., 45 Clinton St.), including steam heating, ventilating, plumbing and electrical work.

Shiprock, N. M.—Bids will be received May 31 by Comr. Indian Affairs, Dept. Interior, Washington, D. C., for furnishing materials and constructing complete buildings, water and sewer systems, etc., at the San Juan School; for further information address W. T. Shelton, Supt., Shiprock.

Long Island City, L. I., N. Y.—Bids will be received May 22 by C. B. J. Snyder, Supt. School Bldgs., New York City, for ventilating and heating apparatus in School No. 24, Boro. Queens; also for the sanitary work and gas fitting in School No. 71, Metropolitan, Boro. Queens.

Amsterdam, N. Y.—The Governor has signed a bill authorizing the issue of $106,600 to secure sites and erect schools.

Ogdensburg, N. Y.—A bill has been signed by the Governor authorizing the raising of $40,000 for school purposes.

**Canton, N. Y.*—The Central Bldg. Co., of Worcester, Mass., it is reported, has received the contract to erect the 3-story brick and stone science hall at St. Lawrence Univ. at about $40,000.

Watervliet, N. Y.—Bids will be received June 5 by the Bd. Educ. (R. H. Bellows, Secy.) for furnishing material and erecting fire escapes on the High School.

Washington, N. C.—Bids will be received May 19 by the Bd. School Trus. (Collin H. Harding, Secy.) for furnishing materials and erecting a school, including plumbing.

Cincinnati, O.—The School Bd. is said to be contemplating the erection of a high school to cost $750,000.

Mt. Gilead, O.—W. F. Wieland, Village Clk., writes that the citizens voted Apr. 22 to erect a high school to cost from $12,000 to $15,000. For further information address, G. J. Young, Clk. School Bd.

Girard, O.—The citizens voted Apr. 14 to issue $38,000 bonds for erecting an addition to high school and also for a new school at North Ave. and Prospect St.

**Cleveland, O.*—Andrews Bros., 176 Euclid Ave., it is reported, have received the contract to erect a school at a cost of about $80,000.

Struthers, O.—Bids will be received June 5 by the Bd. Educ. (A. B. Slough, Clk.) for $35,000 high school improvement bonds.

Groveport, O.—Bids will be received June 5 by the Bd. Educ. of Madison Township (A. M. Senter, Clk.) for erecting a school in Sub Dist. No. 7.

Stillwater, Okla. Ter.—It is reported that the plans have been perfected for the Administration Bldg. which is to be erected at the Stillwater Agricultural & Mechanical College, at a probable cost of $75,000.

Philadelphia, Pa.—Local press reports state that the Bd. of Educ. will receive bids until May 16 for erecting a school at 62d and Lebanon Sts., and 41st St. and Edgeville Ave.

McKeesport, Pa.—Bids will be received June 5 by the School Bd. (C. P. Fielder, Secy.) for $254,000 school dist. bonds.

**Annville, Pa.*—Wm. Weikle, of Lebanon, it is reported, has received the contract to erect the boys' dormitory at Lebanon Valley College at $32,582.

West Chester, Pa.—Bids will be received by the Bd. of Educ. May 22 for the erection of a high school to cost about $75,000. Architects, Seymour and Paul A. Davis, 3d, Philadelphia.

Downingtown, Pa.—The citizens are stated to have voted in favor of issuing $30,000 bonds for the erection of a school.

Webster, S. D.—J. H. Nickle & Co., of St. Paul, Minn., it is stated, submitted the lowest bid for erecting the public school, including plumbing and heating at $41,030.

Pine Ridge, S. D.—Bids will be received June 1 by Comr. Indian Affairs, Dept. Interior, Washington, D. C., for furnishing materials and constructing complete an agency office building, with steam heat, and quarters for the inspectors of day schools, at Pine Ridge Agency.

Big Stone Gap, Va.—Bids will be received May 27 by the School Bd., Big Stone Gap School Dist. (J. F. Bullitt, Clk.) for erecting a stone school, containing about 15 rooms.

Tulalip, Wash.—Bids will be received June 2 by Comr. Indian Affairs, Dept. Interior, Washington, D. C., for furnishing materials and constructing complete school buildings, employees' quarters, water and sewer systems, etc., at the Tulalip School; for further information address Chas. M. Buchanan, Supt., Tulalip.

Clarksburg, W. Va.—W. H. Cole, City Clk., writes that the citizens have voted to issue $60,000 bonds for the erection of new schools.

Huntington, W. Va.—It is stated that bids will be received about June 1 for erecting a building, 130x90 ft., at Marshall College. Holmboe & Lafferty, Fordyce Bldg., Clarksburg, W. Va., are the archts.

**New Richmond, Wis.*—The following are reported to be the bids received for erecting the high school: Fred C. Norlander, of St. Paul, Minn., $36,337 (awarded contract); J. B. Nelson & Co., of Mankato, Minn., $36,430; C. M. Lovine, of St. Paul, Minn., $36,498; C. Ash & Co., of St. Paul, Minn., $38,929; Traiser & Stanley, of New Richmond, $39,155, and Chippewa Falls Constr. Co., of Chippewa Falls, $39,360.

*The American Fdry. & Furnace Co., of Milwaukee, it is stated, received the contract for the ventilating and heating and heat control of said building at $3,795.

Contracts for plumbing and electric wiring have not yet been awarded.

Milwaukee, Wis.—The City Council has passed an ordinance authorizing the issue of $120,000 school bonds.

Cheyenne, Wyo.—The citizens, it is stated, have voted in favor of issuing $35,000 school bonds.

**Regina, N. W. Ter.*—J. Rigby, Secy-Treas. Regina Pub. School Dist. No. 4, writes that the contract for erecting a 12-room brick and stone school (bids opened May 1) has been awarded to A. Kaltenbrunner, of Regina, for $48,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Los Angeles, Cal.—The following are reported to be the bids opened on Apr. 25 by the City Council for a garbage crematory; Decarie Mfg. Co., Minneapolis, Minn., $70,864; Dundon Iron Wks., San Francisco, for a Meldrum patent refuse and garbage destructor, $54,893, and the Standard Constr. Co., Chicago, Ill., $61,500.

**Washington, D. C.*—The Dist. Comrs. are stated to have awarded contracts as follows for collection and disposal of garbage, ashes, etc. (bids opened Apr. 28): To Stutler & Ready for removal of ashes and refuse from all buildings under control of Dist., at 41 cts. per cu. yd. or about $3,000 per year; also same company for removal and disposal of night soil in the Dist. for 5 yrs. at $16,500 per yr. To S. P. Bayly, for collection and disposal of ashes from all places other than the Dist. building for 1 yr., at $54,000. He also secured the contract for collecting miscellaneous refuse for 2 yrs. at $14,000 per yr.

Grand Rapids, Mich.—The Garbage Comn. is stated to have decided to ask Council to appropriate $30,000 for the collection and disposal of garbage.

Kansas City, Mo.—The following are the bids opened on May 1 by the Bd. of Health for the removal of garbage: E. L. House, $29,000; Wm. Crowder, $30,000; Geo. E. Osborne, $30,000, and W. B. Vining, $31,000.

Philadelphia, Pa.—The following are reported to be the bids opened on May 4 by Peter Costello, Dir. Pub. Wks. for the disposal of the city's garbage for the year beginning Jan. 1, 1906: Urban Waste Disposal Co., New York, N. Y.; $444,000; Owen J. Evers, Philadelphia, $448,300; James Curran, Philadelphia, $524,000, and American Product Co., Philadelphia, $538,000.

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Ker & Goodwin, Brantford, Ont., are putting up a 2-story, 70x40-ft. brick building for the manufacture of lathe chucks, etc. About 15 or 20 hp. will be used.

L. W. Buck, Bessemer City, N. C., writes that the erection of a cotton mill at Charlotte, N. C., is being considered, although the matter has not been fully decided.

The Royal Weaving Co., Pawtucket, R. I., has let contract for a 2-story, 521x108-ft. addition to its Darlington mill.

The Nordheim, Tex., Canning Factory will erect a cannery to have a daily capacity of 2,000 cans. L. C. Neutzler, secy.

The Moffatt Machinery Co., Charlotte, N. C., is being organized, with a capital of $100,000, and has bought a site on which to erect a concrete and brick shop to have about 20,000 sq. ft. floor space. The company will be in the market for complete machine shop, pattern shop and foundry equipments. Electric power in two units will be used. W. E. Moffatt, gen. mgr.

The Augusta Mattress & Mfg. Co., 930 Jackson St., Augusta, Ga., is commencing the construction of new buildings, which will consist of about four buildings, each 50x75 ft. Additional machinery will also be installed.

The Lowell, N. C., Cotton Mills will erect a 75x100-ft. building and install 2,000 spindles and a 125-hp. boiler.

The Kettering Milling Co., Inwood, W. Va., will erect a new plant.

Gross Bros., Galesburg, Ill., intend to start about July 1 erecting a building for the manufacture of gloves and overalls.

The Prescott Co., Menominee, Mich., will build a steel castings foundry to have a daily capacity of about 10 tons. The company will require complete foundry equipment, including generators, motors and electric traveling crane.

J. A. Smith, Bessemer City, N. C., writes that he will make brick this summer and build a finishing mill.

The Western Packing & Provision Co., with temporary office at 917 Schiller Bldg., Chicago, Ill., has been incorporated for the purpose of establishing a slaughtering and packing plant at the stock yards, but details are as yet unavailable.

W. H. Lyda, Forest Grove, Ore., will erect a 34x160-ft. sawmill, to have a capacity of 30,000 ft in 10 hours The capacity of the power plant will be 120 hp.

Frank T. McElroy, 120 N. Front St., Steelton, Pa., is seeking a location in which to erect a hosiery mill to employ 70 to 100 girls.

The Chicago File & Rasp Co. will erect a 2-story, 80x110-ft. factory building on North Robey St. and Webster Ave., Chicago, to cost $35,000, according to local newspaper reports.

The Moorehead Mfg. Co., Detroit, Mich., having taken over the business of James Morehead, manufacturer of steam traps, valves, etc., will erect a new factory, according to local newspaper reports.

W. Sanford Vanderzee, Albany, N. Y., is planning to erect a 15,000-bu. grain elevator, according to local newspaper reports.

A permit has been issued to the National Rice Milling Co., New Orelans, La., to erect an elevator at North Peters, Montegut, Press and Chartres Sts., the cost being placed at $51,000, according to local newspaper reports.

Cawley, Clark & Co,, Newark, N. J., whose paint factory was recently burned with a loss of $150,000 will begin work of rebuilding within five or six weeks, according to local newspaper reports.

H. W. Caldwell & Sons, Chicago, have let contracts for a 3-story, 112x186-ft. addition to their plant at Western Ave. and 18th St., according to local newspaper reports. Cost, $50,000.

The Noecker, Rickenbach & Ake Shipbuilding Co., foot of 27th and 28th Sts., Camden, N. J., is building a dry dock and will need electric generator and motors. A machine shop will be built later.

The Barnett Carriage Co., Richmond and Carr Sts., Cincinnati, O., is considering establishing a branch factory somewhere in the west.

The Hoover Stove & Casting Co., Kansas City, Mo., is erecting two 60x100-ft. buildings to be used as foundries. All equipment has not yet been ordered.

Edgar M. Young, Jr., Fredericksburg, Va., contemplates erecting a plant for the manufacture of veneer, baskets, etc.

Woods Bros., Des Moines, Ia., will build additions which will double the capacity of their band-cutter factory, according to local newspaper reports.

The Cummer Mfg. Co., Cadillac, Mich., which manufactures folding crates, is figuring on establishing a factory in Texas.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—Bids will be received by Maj. Graham D. Fitch, Corps Engrs., U. S. A., Little Rock, June 10, for iron work, also on same date for the Portland cement for Lock No. 3, Upper White River, Ark., both advertised in The Engineering Record.

Varner, Ark.—Bids will be received May 24 by the Linwood and Auburn Levee Bd. (G. Waterman, Chmn.) for enlarging levee in Lincoln Co., between the Jefferson and Desha Co. lines; estimated at about 600,000 cu. yds. Geo. De Benghem, Engr., Sarossa, Ark.

Wilmington, Del.—Bids will be received by Capt. C. A. F. Flagler, Corps. Engrs., U. S. A., June 5, for dredging in Smyrna River, Del., as advertised in The Engineering Record.

**Items marked thus give the names of parties awarded contracts.*

Washington, D. C.—Bids will be received June 6 at the Bureau Supplies and Accounts, Navy Dept., Washington, for furnishing at navy yards, Portsmouth, N. H.; Boston, Mass., and Norfolk, Va., a quantity of machine tools, etc., as follows: Drop hammer, trimming press, dust collecting system, grinders, electric traveling crane, drills, planers, shapers, polishers, milling machines and band saw; also on same date for furnishing at the navy yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies, including nuts, spikes, parts of Brown hoisting machinery, iron, pump, brass, lead, copper pipe, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Washington, D. C.—Rear-Admiral Baird, Supt. of the State, War and Navy Dept. building, is reported to have on May 4 opened bids for two light high-speed hydraulic elevators to be installed in the north wing of building near Pennsylvania Ave. entrance; Kieckhefer Elevator Co., of Milwaukee, Wis., $14,200; Otis Elevator Co., of Washington, D. C., $15,780, and Eaton & Prince Co., of Chicago, Ill., $16,500.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Geneseo, Ill.—Bids will be received by the Comrs. of the Green River Special Drainage Dist., June 12, for the construction of ditches, requiring the removal of about 4,500,000 cu. yds. of material, as advertised in The Engineering Record. Specifications on file at office of Engineering Record, 114 Liberty St., New York, N. Y.

Springfield, Ill.—A bill is reported to have been passed by the State Legislature creating an internal improvement commission to investigate the problems of the projected deep waterway and ship canal from Lake Michigan to Mississippi River and appropriating $7,000 for the expenses of the commission.

New Orleans, La.—Bids will be received by the Comrs. Port of New Orleans, May 30, for the construction of Julia St. steel shed No. 2, as advertised in The Engineering Record.

The following are the bids opened on Apr. 29 by the Bureau of Yards and Docks, Navy Dept., for coal storage and coal handling plant complete for the naval station, New Orleans: Wellman-Seaver-Morgan Co., 1298 Central Ave., Cleveland, O., $164,000; Snare & Triest Co., 143 Liberty St., New York, N. Y., $147,900, and Hoshor-Platt Co., 120 Liberty St., New York, N. Y., $147,300.

Bids will be received until May 30 by Capt. B. T. Clayton, Q. M., U. S. A., New Orleans, for constructing additional levees, repairing existing levees and filling in certain parts of reservation at Ft. St. Philip, La., as advertised in The Engineering Record.

New Bedford, Mass.—The following are the bids opened on May 10 by Lieut. Col. J. H. Willard, Corps Engrs. U. S. A., Newport, R. I., for dredging in New Bedford Harbor, Mass.: J. S. Packard Dredging Co., Providence, R. I., 21 cts. per cu. yd. and Chas. M. Cole, Fall River, 19 cts.; cost of proposed work, $10,500.

Corunna, Mich.—It is stated that Maple River in Shiawasse County will be dredged at a probable cost of $45,000, of which the county will pay about eight-tenths of the expense.

Detroit, Mich.—Bids will be received by Maj. Lansing H. Beach, Corps Engrs., U. S. A., June 10, for building concrete superstructure of main pier at Harbor Beach, harbor of refuge, Mich., as advertised in The Engineering Record.

**Breckenridge, Minn.*—John H. Ehlert, Chmn. Bd. Superv., Sub-Drainage Dist. No. 2, writes that W. B. Plaistad, of Breckenridge, has secured the contract for constructing drainage ditches in Sub-Drainage Dist. No. 2, the requiring the removal of 429,678 cu. yds. earth, at 12 cts. per cu. yd.

Roseau, Minn.—It is stated that bids will be received until May 22 by the Co. Aud. for constructing a county ditch, 8 miles long, and estimated to cost $10,000. J. H. Baugh, Engr.

Vicksburg, Miss.—Bids will be received until May 31 by Capt. G. M. Hoffman, Corps Engrs., U. S. A., Vicksburg, for about 1,128,000 cu. yds. of levee work in Third Dist., Miss. River Improv., as advertised in The Engineering Record.

Macon, Mo.—The farmers of Macon County, owning land in the Chariton River bottoms, are reported to have voted to issue $100,000 bonds for the immediate construction of a ditch or canal 9 miles in length to divert course and straighten Chariton River.

**New York, N. Y.*—The following are the bids opened on May 5 by the Dept. Docks & Ferries for building a pier at foot of Beekman St., East River (bidders all of New York): Geo. W. Rogers, $37,300; Aug. Walsh, $39,350; Wm. H. Jenks, $31,350; Genl. Contg. & Eng. Co., $36,166; Bernard Rolf, 39 Cortlandt St., $31,183 (awarded contract); Snare & Triest Co., $32,350, and N. Y. State Constr. Co., $31,731.

Bids will be received by the Dept. Docks and Ferries (Maurice Featherson, Comr.) until May 22 for furnishing materials and constructing 3 pile drivers, 4 boat landing stages, 4 diving scows and 1 derrick; also for furnishing materials and constructing a new pier with lateral extensions or bulkhead platforms, near the ft. W 18th St., North River, to be known as Pier No. 59, all in Manhattan Boro.

Brooklyn, N. Y.—Bids will be received May 18 by the Park Bd., New York City (John J. Pallas, Pres.) for furnishing and delivering Hudson River road gravel on parks and parkways, Boros. Brooklyn and Queens.

St. George, S. I., N. Y.—The following are reported to be the bids opened on May 1 by the Dept. of Docks and Ferries, N. Y. City, for furnishing material and removing present structures and constructing new structures in connection with the new St. George terminal and dredging thereat: Geo. Spearin, $510,285, 17 Battery Pl., N. Y. City; Bernard Rolf, $511,513; Geo. W. Rogers, $523,000, and W. H. Jenks, $517,000.

Ogdensburg, N. Y.—Bids will be received, Lieut.-Col. H. M. Adams, Corps. Engrs., U. S. A., Buffalo, June 6, for channel excavation at Ogdensburg Harbor, as advertised in The Engineering Record.

Utica, N. Y.—The Governor has signed the bill authorizing this city to issue $60,000 bonds to continue the Mohawk River improvement.

New Rochelle, N. Y.—Bids will be received May 16 by Chas. Kammermeyer, City Clk., for constructing a dock in Hudson Park.

Cleveland, O.—Bids will be received June 5 by Lieut. Col. Dan. C. Kingman, Corps Engrs., U. S. A., for dredging in Sandusky Harbor.

Cincinnati, O.—Bids are wanted, June 5, for $350,000 park extension bonds; W. T. Perkins, City Aud.

Columbus, O.—Press reports state that the State Bd. of Pub. Wks. will shortly let contracts for additional work on the Ohio Canal, at a cost of $125,000.

Cleveland, O.—Bids will be received May 23 by the Bd. Pub. Service (A. R. Callow, Secy.) for grading, draining, building, retaining wall and otherwise improving a portion of Gordon Park.

Bids will be received June 8 by Lieut. Col. Dan C. Kingman, Corps Engrs. U. S. A., 262 Huron St., for stone reinforcement and repair of jetties at the harbors of Port Clinton and Vermillion, O.

Toledo, O.—At a meeting of the Co. Comrs. of Lucas, Wood and Ottawa Counties, held recently at the court house at Toledo, it was decided to build a retaining wall in Lake Erie at mouth of Ward Canal in Jerusalem Township; it will be built of concrete on piles, and it will cost about $25,000.

Panama.—The following are reported to be the bids opened on May 10 by the Isthmian Canal Comn., at Washington, D. C.: H. H. Meyer, Baltimore, Md., unloading machines, $23,872; Marion Steam Shovel Co., Marion, O., unloading plows, $4,325, and Mann, McCann Co., Chicago, Ill., earth spreaders, $14,607.

Bids will be received May 31 by Maj. H. J. Gallagher, Purchasing Agent, Isthmian Canal Comn., Washington, D. C., for furnishing dump carts and wagons, wheeled scrapers, etc.

Philadelphia, Pa.—Bids are wanted May 24 for 1,000 cu. yd. reinforced concrete retaining walls, to be constructed at the Frankford Arsenal; Lieut. Col. Frank Heath, Comdg.

Governor Pennypacker on May 8 signed the bill appropriating $375,000 for deepening and improving Delaware River Channel between Philadelphia and Delaware Bay. The work will be done by the Bureau of Surveys of the Philadelphia Dept. Pub. Wks. in accordance with plans of the War Dept.

**Pittsburg, Pa.*—Maj. Wm. L. Sibert, Corps Engrs., U. S. A., writes that the contract for constructing Dam No. 4, Ohio River (bids opened Apr. 19) has been awarded to the Baker Contract Co., of Pittsburg, for $224,044. For detail bids received for the work see issue of The Engineering Record, May 6.

The following are the bids opened Apr. 22 by Maj. Wm. L. Sibert, Corps Engrs., U. S. A., for dredging the approach to navigable pass at Dam No. 2, Ohio River: (*a*) For all work, (*b*) for one-half the work: Monongahela & Western Dredging Co., Pittsburg, *a* 45 cts., *b* 48 cts.; Ohio River Contract Co., Evansville, Ind., *b* 29 cts.; Geo. F. Egan, Pittsburg, *a* and *b*, 39.7 cts.

**Newport, R. I.*—The Morris & Cummings Dredging Co., of New York, N. Y., has secured the contract for dredging at Hyannis and Nantucket, Mass., 230,000 cu. yds. (bids opened May 3) at 23.9 cts. per cu. yd.

Newport, R. I.—The following are the bids opened on May 8 by Lieut. Col. J. H. Williams, Corps Engrs., U. S. A., for dredging in Little Harbor, Woods Hole, Mass., 77,000 cu. yds. (price given per cu. yd.): Chas. M. Cole, Fall River, Mass., 21 cts.; J. S. Packard Dredging Co., Providence, R. I., 23.8 cts., and Morris & Cummings Dredging Co., New York, N. Y., 25.4 cts.

Memphis, Tenn.—Contracts will probably be let in June for the construction of 2 subways under Bway. to cost about $100,000, the work to be under supervision of J. A. Omberg, Jr., City Engr.

Culpeper, Va.—Bids will be received by Capt. A. W. Butt, Depot Q. M., U. S. A., Washington, D. C., June 7, for constructing a rostrum at Culpeper National Cemetery, as advertised in The Engineering Record.

Port Wing, Wis.—Bids will be received by Maj. Chas. L. Potter, Corp Engrs., U. S. A., Duluth, Minn., June 5, for pier work at Port Wing, as advertised in The Engineering Record.

Port Stanley, Ont.—Bids will be received June 5 by the Dept. Pub. Wks. (Fred. Gelinas, Secy.), Ottawa, for constructing 2 breakwaters at Port Stanley.

Aurora, Ont.—Bids will be received by S. H. Lundy, Town Clk., until June 5, for $5,000 local improvement bonds.

Port Colborne, Ont.—Bids will be received until May 22 by L. K. Jones, Secy. Dept. Rys. & Canals, Ottawa, for new docking along the old west pier, at Port Colborne.

Peel Head Bay, Que.—Bids will be received May 29 by the Dept. Pub. Wks. (Fred. Gelinas, Secy.), Ottawa, for constructing a landing pier at Peel Head Bay.

PROPOSALS OPEN

For Proposals see pages 56, 57, 60, 61, 62 and 63.

WATER WORKS.

May 16.	Irrig. work, North Platte, Neb. Adv. Mar. 25 to Apr. 29.	Mar. 25
May 16.	Mains, Ada, Minn.	May 6
May 16.	Pipe, etc., Cleveland, O. Adv. May 6, 13.	May 6
May 16.	Improv., Marshall, Tex.	May 6
May 17.	Lumberton, Miss. Adv. May 6, 13.	May 6
May 17.	Mains, Brooklyn, N. Y.	May 6
May 17.	System, New Madrid, Mo.	May 6
May 17.	Pump, Buffalo, N. Y.	May 13
May 18.	Pipe, valves, etc., Ft. Assinniboine, Mont.	Apr. 29
May 18.	Water wheels, etc., Oswego, N. Y. Adv. May 6, 13.	May 6
May 18.	Pumps, Oswego, N. Y. Adv. May 6, 13.	May 6
May 19.	Pig lead, Cleveland, O.	May 13
May 20.	Crib, intake, etc., Oswego, N. Y. Adv. Apr. 29 to May 13.	Apr. 29
May 20.	Pipe, etc., Chicago, Ill.	May 6
May 22.	Lynch, Neb. Adv. May 6.	May 6
May 24.	Engine, Perth Amboy, N. J. Adv. May 13.	May 13
May 27.	Meters, hydrants, etc., Panama Adv. May 6, 13.	May 6
May 27.	Mains, etc., Portland, Me.	May 13
May 31.	Reservoir, New York, N. Y.	May 13
May 31.	System, Shiprock, N. M.	May 13
Jun. 1,	Canal, etc., Glendive, Mont. Adv. Ap. 8 to May 13.	Apr. 8
Jun. 2.	Engines, etc., Cincinnati, O.	May 6
Jun. 2.	System, Tulalip, Wash.	May 13
Jun. 5.	Irrig. work, Yuma, Ariz. Adv. May 6, 13.	May 6
Jun. 6.	Tunnel, etc., Toronto, Ont. Adv. May 6, 13.	May 6
Jun. 8.	Franchise, Ventura, Cal.	May 6
Jun. 8.	Purification plants, Columbus, O. Adv. May 13.	May 13
Jun. 12.	Pipe, Whittier, Cal. Adv. May 13.	May 13
Jun. 12.	Well, Whittier, Cal. Adv. May 13.	May 13
June 12.	Pump, etc., Whittier, Cal. Adv. May 13.	May 13
Jun. 15.	Canal, etc., Minidoka, Idaho Adv. Apr. 22 to May 13.	Apr. 22
Jun. 15.	Dam, etc., Casper, Wyo. Adv. Apr. 29 to May 13.	Apr. 29
Jun. 15.	Controlling works, etc., Tahoe, Cal. Adv. May 6, 13.	May 6
Jun. 28.	Irrig. work, Billings, Mont. Adv. May 6, 13.	May 6
Jun. 28.	Pump sta., etc., Huntley, Mont. Adv. May 6, 13.	May 6
Jun. —.	Prescott, Wash.	Apr. 1
Jun. —.	Alma, Wash.	Apr. 22

Wheeling, W. Va.—The following are the bids opened on May 3 by Maj. Geo. A. Zinn, Corps Engrs., U. S. A., for building Dam No. 18, Ohio River: (*a*) Brady Constr. Co., Fairmont, W. Va.; (*b*) The Ohio River Contract Co., Evansville, Ind; (*c*) Baker Contract Co., Inc., Pittsburg, Pa.

Dam with service bridge.

	a	*b*	*c*
55,055 cu. yd. common excav	$0.90	$1.00	$0.50
535 cu. yd. rock excav.	3.50	4.00	3.00
14,000 cu. yd. common fill.	.50	.75	.40
350 cu. yd. stone fill.	3.00	2.50	3.00
19.839 M. ft. timber	60.00	50.00	50.00
26.667 M. ft. white-oak timber	90.00	80.00	70.00
154.4 M. ft. yellow pine timber	80.00	100.00	70.00
1,526,870 lbs. iron and steel	.06	.06¼	.06
474,470 lbs. reinforcing steel	.06	.04	.05
20,448 cu. yd. concrete	7.15	7.75	7.00
935 cu. yd. paving	4.00	7.00	5.00
200 lin. ft. curb.	.60	1.00	1.00
100 lin. ft. bolt holes in mas'ry, 2 in. or less diam	.40	.60	.50
800 bolt holes in mas'ry, more than 2 in. diam	1.50	.60	.75
2,460 lin. ft. galv.-iron pipe, 1½ in.	.50	.50	.50
2,460 lin. ft. galv.-iron pipe, 3 in.	.75	1.00	.75
500 lin. ft galv.-iron pipe, 4 in.	1.00	1.50	1.00
Total	$350,373	$371.740	$317,021

Dam without service bridge.

	a	*b*	*c*
45,500 cu. yd. common excav.	$0.90	$1.00	$0.70
200 cu. yd. rock excav.	3.50	4.00	3.00
14,000 cu. yd. common fill.	.50	.75	.70
350 cu. yd. stone fill.	3.00	2.50	3.00
19.839 M. ft. timber	55.00	50.00	60.00
26.667 M. ft. white oak timber	90.00	80.00	80.00
154.4 M. ft. yellow pine timber	80.00	100.00	70.00
1,139,500 lbs. iron and steel	.07	.06¼	.07
13,220 lbs. reinforc. steel	.07	.05	.06
16,865 cu. yd. concrete	6.65	7.65	6.00
935 cu. yd. paving	4.00	7.00	6.00
200 lin. ft. curb.	.60	1.00	1.00
100 lin. ft. bolt holes in masonry, 2 in. or less, diam.	.40	.60	.50
800 bolt holes in masonry, more than 2 in. diam.	1.50	.60	.75
2,460 lin. ft. galv.-iron pipe, 1½ in.	.50	.50	.50
2,460 lin. ft. galv.-iron pipe, 3 in.	.75	1.00	.75
500 lin. ft. galv.-iron pipe, 4 in.	1.00	1.50	1.00
Total	$267,106	$288,912	$249,250

***Items marked thus give the names of parties awarded contracts.**

Jun. —.	Pumps, etc., Richland, Ga.	Apr. 22
Jun. —.	Pipe, etc., Thibodaux, La.	Apr. 22
Jun. —.	Improv., Tex.	Apr. 29
———	Granbury, Tex.	Apr. 29

SEWERAGE AND SEWAGE DISPOSAL.

May 16.	Washington, D. C.	May 6
May 16.	Green Bay, Wis.	May 6
May 16.	Sharon Hill, Pa. Adv. May 16.	May 6
May 16.	Toledo, O.	May 13
May 16.	Trenton, N. J.	May 13
May 17.	Washington, D. C. Adv. Apr. 22, 29.	Apr. 22
May 17.	Amsterdam, N. Y.	May 6
May 17.	Brooklyn, N. Y.	May 13
May 17.	Chicago, Ill.	May 13
May 18.	Mt. Carmel, Pa. Adv. Apr. 29, May 13.	Apr. 29
May 18.	Columbus, O.	May 6
May 18.	Pipestone, Minn.	May 13
May 18.	Ballston Spa, N. Y. Adv. May 13.	May 13
May 19.	Steubenville, O. Adv. May 6, 13.	May 6
May 19.	Puyallup, Wash.	May 6
May 19.	Peterboro, Ont.	May 13
May 20.	Marion, S. C.	May 6
May 22.	New Rochelle, N. Y.	May 13
May 23.	Painesville, O.	May 13
May 25.	North Plate, Neb., Adv. May 6, 13.	May 6
May 25.	North Platte, Neb. Adv. May 6, 13.	May 6
May 27.	Hopkinsville, Ky.	May 13
May 29.	Cincinnati, O.	May 6
May 31.	Shiprock, N. M.	May 13
May 31.	Pine Bluff, Ark. Adv. May 13.	May 13
May —.	New Britain, Conn.	Apr. 8
June 1.	Darlington, S. C.	May 13
June 2.	Tulalip, Wash.	May 13
June 5.	Webb City, Mo. Adv. May 13.	May 13
June —.	Sacramento, Cal.	May 13

BRIDGES.

May 15.	Middletown, N. Y. Adv. May 13.	May 13
May 16.	Kingstree, S. C.	Apr. 29
May 16.	Cleveland, O.	May 6
May 16.	Birmingham, Ala.	May 13
May 17.	Cleveland, O.	Apr. 22
May 17.	Pittsburg, Pa.	Apr. 29
May 19.	Britton, S. D.	May 13
May 20.	Lenox, Mass.	May 13
May 20.	Mitchell, S. D.	May 6
May 22.	New Rockford, N. D.	May 6
May 22.	Schuyler, Neb.	May 13
May 23.	French Lake, Minn.	May 13
May 23.	Toledo, O.	May 13
May 24.	Ellendale, N. D.	Apr. 29
May 25.	Zanesville, O.	May 6
May 25.	West Newton, Pa.	May 13
May —.	New Britain, Conn.	Apr. 8
Jun. 1.	Lima, O.	May 13
Jun. 1.	Mallory, Minn.	May 13
Jun. 6.	Dayton, O. Adv. May 13.	May 13

PAVING AND ROADMAKING.

May 16.	Trenton, N. J.	May 6
May 16.	Washington, D. C.	May 6
May 16.	Upper Marlboro, Md.	May 6
May 16.	New York, N. Y.	May 13
May 16.	Sandusky, O.	May 13
May 16.	Rensselaer, N. Y.	May 13
May 16.	Butler, Pa.	May 13
May 17.	Terre Haute, Ind.	May 6
May 17.	Oconomowoc, Wis.	May 13
May 17.	Chicago, Ill.	May 13
May 17.	Dunnville, Ont.	May 13
May 17.	Louisville, Ky.	May 13
May 18.	Montreal, Que.	May 13
May 19.	Richmond, Va.	May 6
May 19.	West Boylston, Mass. Adv. May 13.	May 13
May 19.	Buffalo, N. Y.	May 13
May 20.	Ft. Mackenzie, Wyo. Adv. Apr. 29.	Apr. 29
May 20.	Washington, D. C. Adv. May 6, 13.	May 6
May 22.	Bluefield, W. Va. Adv. Apr. 29 to May 6.	Apr. 29
May 22.	Wyoming, O.	Apr. 29
May 22.	Canton, O.	May 6
May 22.	Elmira, N. Y. Adv. May 6, 13.	May 6
May 22.	Little Rock, Ark.	May 13
May 22.	Binghamton, N. Y.	May 13
May 23.	Painesville, O.	May 13
May 23.	Red Jacket, Mich. Adv. May 13.	May 13
May 23.	Madisonville, O.	May 13
May 24.	Brooklyn, N. Y.	May 13
May 24.	Ft. Leavenworth, Kan.	May 13
May 25.	Reading, Pa.	May 13
May 26.	Arnprior, Ont.	May 13
May 27.	Ft. Ontario, N. Y. Adv. Apr. 29 to May 13.	Apr. 29
May 27.	Portland, Me.	May 13
May 29.	Cincinnati, O.	May 6
May 31.	Washington, D. C.	May 13
May 31.	San Francisco, Cal.	May 13
Jun. 1.	Owensboro, Ky.	Apr. 22
Jun. 1.	Findlay, O.	May 13
Jun. 1.	Tacoma, Wash.	May 13
Jun. 2.	Cincinnati, O.	May 6
Jun. 5.	Cincinnati, O.	May 13
Jun. 6.	Waterbury, Conn.	May 13
Jun. 6.	Indianapolis, Ind.	May 13
Jun. 6.	Amsterdam, N. Y.	May 13
Jun. 7.	Flemington, N. J. Adv. May 13.	May 13
Jun. 19.	New Orleans, La. Adv. May 13.	May 13
———	Grenada, Miss.	Apr. 29

POWER, GAS AND ELECTRICITY.

May 17.	Oxford, Pa.	May 6
May 18.	Ashland, Va.	May 6
May 18.	Oswego, N. Y., Adv. May 6, 13.	May 6
May 19.	Lincoln, Neb.	May 13
May 20.	Washington, D. C. Adv. May 6, 13.	May 6
May 20.	Ft. Hancock, N. J.	May 6
May 20.	Washington, D. C. Adv. May 13.	May 13
May 22.	Philadelphia, Pa. Adv. May 6.	May 6
May 22.	Brooklyn, N. Y.	May 13
May 22.	Washington, D. C. Adv. May 13.	May 13
May 22.	Long Island City, L. I., N. Y.	May 13
May 23.	Washington, D. C.	Apr. 29
May 23.	Washington, D. C.	May 13
May 26.	Kankakee, Ill.	May 6
May 31.	Washington, D. C. Adv. Apr. 29 to May 6.	Apr. 29
May 31.	Washington, D. C.	May 13
Jun. 1.	Spartanburg, S. C.	Apr. 29
Jun 3.	Cape Charles, Va.	Apr. 8
Jun. 6.	Sebastapol, Cal.	Apr. 22
Jun. 6.	Shelbyville, Tenn.	May 13
Jun. 8.	Newport, Ky.	Apr. 29
Jun. —.	Reading, O.	May 13

BUILDINGS.

May 16.	Pub. Bldg., Elkhart, Ind.	Apr. 15
May 16.	Court house, Utica, N. Y.	May 6
May 16.	Pub. bldg., Lafayette, Ind.	May 6
May 16.	Post. bldg., Ft. Missoula, Mont.	May 6
May 16.	Pub. Bldg., Chicago, Ill.	May 13
May 16.	School, Philadelphia, Pa.	May 13
May 17.	Pub. Bldg., Wash., D. C.	Apr. 22
May 17.	Hospital, Dayton, O.	Apr. 22
May 17.	Pub. Bldg., Ft. G. H. Wright, N. Y.	May 6
May 17.	School, Saltville, Va.	May 6
May 17.	Hospital, Kings Park, N. Y. Adv. May 6, 13.	May 6
May 17.	Pub. Bldg., Winona, Minn.	May 13
May 17.	Pub. Bldg., New York, N. Y.	May 13
May 17.	Stable, Brooklyn, N. Y.	May 13
May 18.	Pub. Bldg., National Home, Wis.	Apr. 22
May 18.	Pub. bldg., San Francisco, Cal.	May 6
May 18.	Library, Howell, Mich.	May 13
May 18.	Jail, Centreville, Tenn.	May 13
May 18.	Court House, Shelbyville, Ind.	May 13
May 19.	Mech. equip. P. B., New York, N. Y, Adv. May 13.	May 13
May 19.	Post Bldg., Ft. Screven, Ga. Adv. May 13.	May 13
May 19.	Jail, Savannah, Mo.	May 13
May 19.	School, New Haven, Conn.	May 13
May 19.	School, Washington, N. C.	May 13
May 20.	School, Brooklyn, O.	Apr. 29
May 20.	Prison, Trenton, N. J.	May 6
May 20.	School, Columbus, Ind.	May 13
May 20.	Church, O'Fallon, Ill.	May 13
May 22.	Post Bldgs., Prescott, Ariz. Adv. Apr. 15 to May 13.	Apr. 15
May 22.	P. O. Bldg., Oil City, Pa. Adv. Apr. 15, 22.	Apr. 15
May 22.	Post Bldgs., Wash. Barracks, D. C. Adv. Apr. 29 to May 13.	Apr. 29
May 22.	School, Austin, Pa.	May 6
May 22.	School, Ashland, Wis.	May 6
May 22.	School, West Chester, Pa.	May 13
May 22.	Schools, Long Island City, L. I., N. Y.,	May 13
May 22.	Engine house, New York, N. Y.	May 13
May 22.	Schools, New York, N. Y.	May 13
May 22.	Synagogue, Greenville, Miss.	May 13
May 23.	P. O. Bldg., Owosso, Mich.	Apr. 22
May 23.	Hospital, Raleigh, N. C.	Apr. 29
May 23.	School, Cape Girardeau, Mo.	May 6
May 23.	Schools, Newark, N. J.	May 13
May 23.	Court house, Manitowoc, Wis.	May 13
May 23.	Machine shop, Newport, R. I.	May 13
May 24.	P. O. Bldg., Pekin, Ill.	Apr. 29
May 24.	School, Corydon, Ia.	May 6
May 24.	Hospital, Jersey City, N. J.	May 6
May 25.	P. O. Bldg., Geneva, N. Y. Adv. Apr. 22, 29.	Apr. 22
May 25.	Post Bldg., Ft. du Pont, Del. Adv. Apr. 29 to May 13.	Apr. 29
May 25.	Post Hosp., Ft. Riley, Kan. Adv. Apr. 29 to May 13.	Apr. 29
May 25.	Church, Indianapolis, Ind.	May 6
May 25.	School, Fairfax, Minn.	May 13
May 26.	School, Indianapolis, Ind.	May 13
May 26.	School, Tipton, Ind.	May 13
May 27.	Post bldgs., Vancouver Bar., Wash.	May 6
May 27.	Post bldgs., Ft. Ethan Allen, Vt. Adv. May 6, 13.	May 6
May 27.	School, Big Stone Gap, Va.	May 13
May 29.	Htg. P.-O. bldg., Kankakee, Ill.	May 6
May 29.	Light house, Tompkinsville, N. Y.	May 6
May 29.	School, Marble Rock, Ia.	May 13
May 29.	School, Jefferson, Ia.	May 13
May 31.	P. O. Bldg., Allentown, Pa.	Apr. 29
May 31.	Boat house, etc., Philadelphia, Pa.	May 6
May 31.	Courthouse, Baltimore, Md.	May 13
May 31.	School, Shiprock, N. M.	May 13
May 31.	Court house, Darlington, Wis.	May 13
Jun. 1.	P. O. Bldg., Little Falls, N. Y. Adv. Apr. 29 to May 6.	Apr. 29
Jun. 1.	Bank, Knoxville, Tenn.	Bay 6
Jun. 1.	School, Pine Ridge, S. D.	May 13
Jun. 1.	School, Huntington, W. Va.	May 13
Jun. 2.	Bus. building, Washington, Ind.	May 13
Jun. 2.	School, Tulalip, Wash.	May 13
Jun. 5.	Capitol, Frankfort, Ky.	Apr. 22
Jun. 5.	P. O. Bldg., Crawfordsville, Ind.	Apr. 29
Jun. 5.	School, Watervliet, N. Y.	May 13
Jun. 5.	School, Groveport, O.	May 13
Jun. 6.	P. O. Bldg., Rockhill, S. C.	Apr. 29
Jun. 7.	P. O. bldg., Reno, Nev.	May 6
Jun. 7.	Pub. buildings, Honolulu, H. I.	May 13
Jun. 8.	P.-O. bldg., Amesbury, Mass. Adv. May 6, 13.	May 6
Jun. 10.	Schools, Alaska	May 6
Jun. 10.	Court house, Plaquemine, La. Adv. May 6, 13.	May 6
Jun. 12.	Capitol plans, Boise, Idaho	Apr. 22
Jun. 15.	Court House plans, New Orleans, La. Adv. Apr. 29.	Feb. 25
Jun. 15.	Synagague plans, Houston, Tex.	Apr. 15
Jun. 15.	Court House plans, New Orleans, La.	Apr. 22
Jun. 15.	Pub. bldg., Honolulu, H. I.	Apr. 29
Jun. 20.	School, Dillon, Mont.	Apr. 15
———	School plans, Needham, Mass.	Apr. 22
———	Jail, etc., Beaufort, N. C.	Apr. 15
———	Bus. Bldg., Mineral Wells, Tex.	Apr. 29
———	Factory, Corinth, Miss.	Apr. 29
———	Pub. bldg., St. Louis, Mo.	May 13
Jul. 30.	Court House improv., Leesville, La.	May 13
Aug. 1.	Y. M. C. A. Bldg., Spokane, Wash.	Apr. 29

MISCELLANEOUS.

May 16.	Supplies, Washington, D. C.	Apr. 15
May 16.	Dredging, etc., Milwaukee, Wis. Adv. Apr. 22 to May 13.	Apr. 22
May 16.	Supplies, Wash., D. C.	May 6
May 16.	Cement, Wheeling, W. Va. Adv. Apr. 22 to May 13.	Apr. 22
May 16.	Retaining wall, Trenton, N. J.	May 6
May 16.	Transit tunnel, Boston, Mass. Adv. Apr. 29 to May 6.	Apr. 29
May 16.	Cranes, Panama Adv. Apr. 22 to May 13.	Apr. 29
May 16.	Park improv., Cleveland, O.	May 6
May 16.	Dock, New Rochelle, N. Y.	May 13
May 16.	Pine, etc., Panama Adv. Apr. 15 to May 13.	Apr. 15
May 17.	Fire escapes, Wash., D. C.	Apr. 22
May 17.	R. R. tools, etc., Panama Adv. Apr. 29 to May 6.	Apr. 22
May 17.	Supplies, Watertown, Mass. Adv. Apr. 15 to May 6.	May 6
May 17.	Dredging, New London, Conn.	May 6
May 18.	Brick, screens, etc. Panama Adv. Apr. 22 to May 13.	Apr. 22
May 18.	Explosives, Panama, Adv. Apr. 22 to May 13	Apr. 22
May 18.	Wharf, San Francisco, Cal.	May 6
May 18.	Retaining wall, Wheeling, W. Va.	May 6
May 18.	Park improv., Brooklyn, N. Y.	May 13
May 19.	Jetty work, Savannah, Ga. Adv. Apr. 22 to May 13.	Apr. 22
May 19.	Pine, Panama. Adv. Apr. 22 to May 13	Apr. 22
May 19.	Pier, Cleveland, O.	Apr. 22
May 19.	Lock gates, etc., Pittsburg, Pa.	Apr. 29
May 19.	Drainage, Havana, Ill.	May 6
May 20.	Breakwater, Buffalo, N. Y. Adv. Apr. 22 to May 13.	Apr. 22
May 20.	Dam, Rock Island, Ill. Adv. Apr. 22 to May 13.	Apr. 22
May 20.	Dam improv., Pittsburg, Pa.	Apr. 29
May 20.	Dredging, Milford, Conn. Adv. May 6, 13.	May 6
May 20.	R. R. work, Oglethorpe, Ga.	May 13
May 22.	Pier, Erie, Pa. Adv. Apr. 29 to May 13.	Apr. 29
May 22.	Dredging, Cleveland, O.	Apr. 29
May 22.	Supplies, Philadelphia, Pa.	May 6
May 22.	Pier, etc., New York, N. Y.	May 13
May 22.	Ditch, Roseau, Minn.	May 13
May 22.	Pier improv., Port Colborne, Ont.	May 13
May 23.	Supplies, Washington, D. C.	Apr. 22
May 23.	Breakwater, Block Island, R. I. Adv. Apr. 29 to May 13.	Apr. 29
May 23.	Dredging, Block Island, R. I. Adv. Apr. 29 to May 13.	Apr. 29
May 23.	Remov. rock, Buzzards Bay, Mass. Adv. Apr. 29 to May 13.	Apr. 29
May 23.	R. R. supplies, New Orleans, La.	Apr. 29
May 23.	Park improv., Cleveland, O.	May 13
May 24.	Pipe, tools, etc., Panama. Adv. Apr. 29, May 6.	Apr. 29
May 24.	Pier, Baltimore, Md. Adv. May 6, 13.	May 6
May 24.	Levee, Varner, Ark.	May 13
May 24.	Retaining walls, Philadelphia, Pa.	May 13
May 25.	Levee work, Memphis, Tenn. Adv. Apr. 29 to May 13.	Apr. 29
May 25.	Drain, Marion, O. Adv. May 6.	May 6
May 25.	R. R. work, Asheville, N. C.	May 13
May 26.	Dredging, Buffalo, N. Y. Adv. Apr. 29 to May 13.	Apr. 29
May 27.	Lock, etc., Pittsburg, Pa. Adv. Apr. 29 to May 13.	Apr. 29
May 29.	Lock gates, etc., Nashville, Tenn. Adv. Apr. 29 to May 13.	Apr. 29
May 29.	Excav., Boston, Mass. Adv. Apr. 29 to May 13.	Apr. 29
May 29.	Dredging, Portland, Me. Adv. May 6, 13.	May 6
May 29.	Lock, Plaquemine, La. Adv. May 6, 13.	May 6
May 29.	Sea slope, etc., Buffalo, N. Y. Adv. May 6, 13.	May 6
May 30.	Steel shed, New Orleans, La. Adv. May 13.	May 13
May 30.	Levee work, New Orleans, La. Adv. May 13.	May 13
May 31.	Dredge, Galveston, Tex. Adv. May 6, 13.	May 6
May 31.	Docks, etc., Cincinnati, O.	May 6
May 31.	Dredging, Mobile, Ala. Adv. May 6, 13.	May 6
May 31.	Supplies, Washington, D. C.	May 13
May 31.	Dump carts, etc., Panama	May 13
May 31.	Pier, Peel Head Bay, Que.	May 13
May 31.	Levee work. Vicksburg, Miss. Adv. May 13.	May 13
Jun. 1.	Telephone system, Glendive, Mont., Adv. Apr. 29, May 13.	Apr. 29
Jun. 2.	Channel, Grand Rapids, Mich. Adv. May 6, 13.	May 6
Jun. 5.	Breakwater, Port Stanley, Ont.	May 13
Jun. 5.	Timber, Nashville, Tenn.	May 6
Jun. 5.	Dredging, Cleveland, O.	May 13
Jun. 5.	Pier work, Port Wing, Wis. Adv. May 13.	May 13
Jun. 5.	Dredging, Wilmington, Del. Adv. May 13.	May 13
Jun. 6.	Channel excav., Ogdensburg, N. Y. Adv. May 13.	May 13
Jun. 6.	Supplies, Washington, D. C.	May 13
Jun. 7.	Rostrum, Culpeper, Va. Adv. May 13.	May 13
Jun. 8.	Dikes, Augusta, Ga. Adv. May 6, 13.	May 6
Jun. 8.	Drainage canal, Onawa, Ia.	May 6
Jun. 8.	Jetty work, Cleveland, O. Adv. May 13.	May 13
Jun. 10.	Iron wk. for lock, Little Rock, Ark. Adv. May 13.	May 13
Jun. 10.	Pier, Detroit, Mich., Adv. May 13.	May 13
Jun. 10.	Cement for lock, Little Rock, Ark. Adv. May 13.	May 13
Jun 12.	Ditch work, Geneseo, Ill.	May 13
Jun. 15.	Pole and telephone line, Minidoka, Idaho. Adv. Apr. 22 to May 13.	Apr. 22
Jun. 15.	Wharf, etc., Honolulu	Apr. 29
Jun. —.	Dam, Iowa City, Ia.	Apr. 22
Jun. —.	Subway, Memphis, Tenn.	May 13
Jul 1.	Municipal St. Ry. system, Chicago, Ill. Adv. Apr. 15 to May 6.	Apr. 15
Aug. 26.	Coal plant, Olongapo, P. I.	May 6
Sep. 1.	Steel and iron, Sydney, N. S. Wales. Adv. Apr. 8, 22, May 6.	Apr. 22
———	R. R. work, Oglethorpe, Ga.	Apr. 22
Apr. 2, '06.	Harbor Work, Valparaiso, Chili. Adv. Apr. 29 to May 13.	Apr. 29